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THE

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PRIVATE PRACTICE BY PROFESSORS.

IN a somewhat lengthy leading article, an engineering contemporary sadly laments the hardness of heart exhibited by those governing bodies of engineering colleges who, in their stipulations, state "that the professors shall not engage in private practice. The whole of their time is to be devoted to their students, or, at least, no part of it is to be employed in doing professional work to be paid for in fees."

"Curiously enough," the writer proceeds, "this proviso is limited to actual creative work. Professors may, and do, write books which are paid for by publishers; they deliver lectures for which they expect remuneration, and when they make inventions they patent them. It certainly would be intolerable if they were not free to do any of these things, since the most autocratic of employers leaves his servants at liberty to fill their leisure hours as they please."

We do not desire in this matter to be dictatorial, especially as we are reminded by the writer of the article that "it is very deteriorating to the character to be always in a position of superiority, and to be able to lay down the law without risk of contradiction," Still, there are one or two points raised by him to which something might be added with advantage.

There is a singularity in the sense in which he uses the term "professional work" in the above rendering of the stipulation. Surely its chief meaning is that the professor is not to *teach* at other colleges than that to which he is appointed. The governing bodies of engineering colleges have yet to learn that "professor" is synonymous with "consulting engineer," and in their crass ignorance they imagine that in precluding him from "private practice" they retain him as peculiar to themselves.

Again, by "professorial work to be paid for in fees," it is not to be inferred that the appointing governors have sufficiently advanced in modern diction to know that this refers to the giving of advice and lending of names to private and public companies.

"Curiously enough" *we* do not find that "this proviso *is* limited to actual creative work" at all. Its main object is, undoubtedly, to uphold the dignity and fair repute of their own institution by preventing the names of their own professors from appearing on the syllabus of any second college. The governing body, in fact, want men of high capability; and they want the world to know that they have such men. They have learnt that the status of a college is determined, in great measure, by the efficiency of its professorial staff.

The conception which our contemporary has of the professor whom the governing body will appoint is delicately wrought—from the raw material to the finished machine.

He is evolved from a young man of talent in mathematics and physics, to which is super-added a theoretical knowledge of engineering science,—as it were—thrown in.

If, notwithstanding his assumed ignorance of practical detail, he is allowed to exercise his talents as a consulting engineer, he will blossom into notoriety; but if, on the contrary, they "take steps to prevent him attaining maturity by binding him down not to engage in private practice," he will, in their own words, degenerate into "a mere spectator in the engineering world." *Spectre* was probably meant.

Already we feel that our character has undergone a good deal of deterioration by thus laying down the law, but we hazard one step further. It is with regard to the professor later on in his career. The article has it, that "the man who has passed middle life is out of place in the class-room. Not only have his years erected a barrier between him and the young men in his charge, but he has no longer that complete acquaintance with the details of science that is required of him." We deny that statement, taking all the risk. All who are acquainted with college routine must have learnt that it is men well advanced in years to whom the students prefer to go for information and advice; and his years, far from being a barrier, are a special assurance that his advice will be sound and his information exact.

Rather, we would venture to say the young man is out of place as a professor of engineering. He may do very well to teach the collateral subjects of mathematics, physics, drawing, &c., but for the great central studies—descriptive engineering, mechanical engineering, bridge design, &c., let us have the man appointed who has gained his knowledge on these points at the only school where it can be rightly acquired—in the world's great engineering works outside—before he commences to teach them.

THE POSTMASTER-GENERAL'S REPORT FOR 1890—91.

THE thirty-seventh annual report of the Postmaster-General, being the report for the year ending March 31st, 1891, devotes but a very small space to electrical subjects. It tells us that in the course of the year 239 post offices and 36 railway offices were opened for postal telegraph business, thereby raising the total number of such offices open on March 31st, 1891, to 5,912 and 1,715, respectively.

The construction and operation of the telephone line between London and Paris forms the chief novelty of the year. It is explained that the cable between St. Margaret's Bay, near Dover, and Sangatte, near Calais, "contains four copper wires of larger size than those generally used for telegraphs." The route selected for the land lines has, with the working of the entire undertaking, proved perfectly satisfactory—conversation between the two capitals being "most satisfactorily maintained." Wheatstone working has been further improved, so that at the present moment, "under experimental conditions," a speed of no less than 600 words per minute can be attained over a single wire, while a speed of 400 words a minute can be "conveniently and safely used in practical work." A considerable saving in the cost of manufacture of telephone switchboards has been effected by ingenious tools specially designed for the purpose, and provision has been made for the manufacture in the Post Office factory of all parts of the Hughes instrument, "so that the Department is no longer dependent on a foreign supply," would thus appear to complete the record of advances made in the telegraph branch of the service.

The Department is to be congratulated on the increase of speed achieved with the Wheatstone, to which it would seem almost impossible to apply a limit; but how a large saving in the cost of switchboards for telephone exchanges is to materially affect the revenue—for that is the construction we apply to the remarks of the Postmaster-General—we scarcely see our way to realise. The report affords us no information as to the extent of the connection existing between the Post Office and the telephone companies; what revenue is derived from licenses granted to the companies; nor does it give any idea of the work dealt with by the telephone service of the Department, or by the National Telephone Company. The business carried on by the Post Office, however, in this direction, cannot be of such an extent as to admit of any material economy in switchboards, and we are thus tempted to ask in what way we are to apply the economy shadowed forth by the Postmaster-General? Do his remarks apply to the present or the future? That the Department is sensible of keen competition arising with the telephone communications already established is clear from the admission that the reduced increase in the number of inland telegrams (6·5 per cent. as compared with 8·5 per cent. for the preceding year) is "probably due to no small extent to the increasing use of the telephone both in the metropolis and chief provincial towns, as well as between the busy centres." Is the Department, then, about to enter into open competition with the telephone companies—to make and establish competitive exchanges? We would rather not place such a construction upon these remarks, but it is difficult to apply them in any other way, unless we are to regard them as having no importance whatever. Competition between the Post Office and the telephone companies is to be deprecated in every way. The telephone companies are practically in the hands of the Post Office; they work only under license granted by that Department of the State. It is within the power of the Government to place many obstacles in their way, against which they have but their enterprise, existing footing, and such public sympathy as they may have earned. The establishment of new and independent exchanges will prove a tax upon the Post Office, involve the Department in a considerable outlay, and place subscribers to additional expense, and all to effect but one termination—the absorption of the telephone system by the Post Office. If such is to be the end, we cannot help thinking that the interest of the community lies in the immediate acquisition of the telephone service. If eventually it is to come into the hands of the Government, why not give it immediate effect. There are few, we venture to think, who look for any other ultimate result. To enter into competition for the purpose of depreciating the value of the telephone interest will, we feel assured, cost the Department quite as much as would be attained by whatever depreciation such action on the part of the Government might produce; whilst such a course could not fail to elicit an expression of just indignation on the part of a large portion of the community.

The Postmaster-General's report, as a record of the progress of the telegraph branch of the service is—aside from the pounds, shillings, and pence question, and the number of messages dealt with—intensely disappointing. Having re-

gard to the fact that it is the only official record vouchsafed to the public, there is reason to expect something beyond this. That this is clear to those by whom the report is drafted is evident from the fact that an attempt is made to satisfy the public by informing them how great is the progress with the Wheatstone, with the telephone between London and Paris, and with the manufacture of telephone switchboards. Might we not go a little further? Are pneumatic arrangements at a stand-still? Is there no improvement to chronicle? Is there no advance in the forms of batteries employed, instrument apparatus, or in the method of handling the vast and annually increasing business of this branch of the Department? It is noticed that appended to the report are extracts from the report of the the Comptroller of the Savings' Bank Branch, affording certain detailed information respecting the progress of that Department. Would it not be possible to append to the future reports of the Postmaster-General a report from the chief of the electrical department? Such a proceeding would entail but little trouble; would in no way detract from, but rather add to, the value of the Postmaster-General's own remarks, and would be generally acceptable as illustrative of the work of a branch of the Post Office service, the progress of which is undeniable and is keenly watched by the public at large.

A BROADER BASIS FOR TECHNICAL COLLEGES.

THE danger of the mechanical world being overcrowded by "briefless" engineers, and electricians in *embryo*, is daily becoming more manifest. From all quarters the great question is raised as to what they will find to do when fully developed, and whether it is wise to continue their propagation.

The example set some ten years ago by the City and Guilds of London, when they endowed and organised a Technical College at Finsbury, has been followed assiduously in most of our great towns. It called into existence a revised scheme of education throughout our country; and opened up a new and hopeful field for our younger men, at a time when they were particularly at a loss for some employment in which they might develop their minds simultaneously with using their hands.

Finsbury Technical College started with the subjects: mechanics, electricity and chemistry. These have been taken up by other institutions also, and, as a natural consequence, the number of would-be engineers and electricians has rapidly increased, and the demand for them proportionately diminished. Many of those who have failed to obtain employment are taken over, for a good round sum, by the leading electrical and engineering firms. Overcrowding, in this sense, is not objected to in the least at, say, £300 a head. But this does not remove the difficulty as to what they will find to do in the near future, when they are fully-fledged engineers and electricians.

This matter is discussed in the pages of the *Engineer*. Almost with tears in their editorial eyes, they declare, "we know of one case where the engineering failure earned a living by playing the cornet in the orchestra of a London theatre." Now, if his cornet playing was well done, there seems very little reason to lament his lot. The engineers have lost a trumpeter, it is true; but the orchestra has gained an engineer. In the present century engineers need not seek far for others of this type.

Dr. S. P. Thompson, when speaking at the annual dinner of the Old Students' Association, last week, pointed out the way in which the dangers are to be avoided and the difficulties in question overcome. "The intention is to establish our technical colleges on a wide basis." This appears to us an excellent answer to a host of queries. The term "technical" is sufficiently inclusive to cover all things, and there is no reason why one industry should be favoured above another, and engineering above them all. Already the technical colleges are extending their scope of subjects, and in proportion as they widen their basis of studies, their capacity for usefulness will grow.

There is always this peculiarity in things: that the best work is done by the man who does it in the best way. It is the function of technical colleges to show men the most efficient method of using their powers, whatever be their profession or trade. Engineers will always have the credit of bringing technical instruction forward in this country; and we may fairly expect that when the first of the reaction due to their special efforts, has subsided, they will have little to complain of from overcrowding, for other industries will by that time have reached a similar high development, upon the lines suggested in the first instance, by the engineers themselves.

The Calculation of the magnetic rotation of the Plane of Polarised Light.

A NOTE was read on the above subject by Mons. G. Hinrichs, at a meeting of the Paris Academy of Science, on October 19th, which was substantially as follows:—In a uniform magnetic field the rotation of the plane of polarisation of light is exactly proportional to the length, l, of the homogeneous optic medium traversed in the direction of the magnetic axis of the magnet or of the solenoid. If k be the rotation for unit length, then

$$r = k\,l \qquad (1)$$

This formula is applicable to the molecular rotation of a normal paraffin. Thus, if k be the rotation for each of the n C H_2 groups, n being $= l$, and if h stand for the rotation of each of the terminal atoms of H, then

$$r = k\,n + 2\,h \qquad (2)$$

a formula which expresses the molecular magnetic rotation of a normal paraffin of the series $C_n H_{2n+2}$, which may be written n C H_2 + 2 H. Several other classes of substances contain n C H_2 as their leading constituent, and if K represent the value of the rotation of the constituent in which the difference exists, then the expression for such compounds becomes

$$r = k\,n + h + K \qquad (3)$$

This equation is modified in special cases according as the substance is an alcohol, aldehyde, acid, &c. The formula for determining the magetic rotation of the amines is very complicated; for the general form consult *Proc. Amer. Assoc. Advancement of Sci.*, 1868, p. 236. In equation (3) putting in the value which experiments have obtained, we get

$$r = 1{\cdot}023\,n + 0{\cdot}255 + K \qquad (4)$$

It is thus seen that the molecular magnetic rotation of the plane of polarisation of light by liquids can be reduced to the fundamental law of Faraday and Verdet. For further information and references to correlated work, the original note should be consulted, pp. 500—502, *Comptes Rendus*, cxiii.

ON THE VALUE OF THE ELECTRO-STATIC TENSION IN THE DIELECTRIC.

The value of the tension in the dielectric is that which is obtained by calculating the quantity of movement of the electric fluid supposed to be incompressible.

The flow of induction is generally defined as being the product of the electromotive force by the element of surface, but if we keep to the single hypothesis of an incompressible fluid flowing from one centre or any number of centres, the properties of the potential remain without the intervention of any outside action. This hypothesis is mentioned by Maxwell in one of his notes.

The point, m, is the centre of a radiating flow of incompressible fluid; a constant volume, v, passes in the unit of time through a spherical surface, of which m is the centre, with a radius, r. We can easily see that the speed is

$$u = \frac{d\,r}{d\,t} = \frac{\mathrm{v}}{4\,\pi\,r^2} \qquad (1)$$

and that, calling the density of the fluid, δ, the mass passing through the unit of surface in the unit of time is

$$m = \delta\,\frac{\mathrm{v}}{4\,\pi\,r^2} \qquad (2)$$

I assume (M. L. de la Rive in *Comptes Rendus*) centres of flow acting by progression, or positive centres, and centres acting by aspiration, or negative centres. I suppose in the second place, that at any given point the simultaneous speeds of the fluid, such as they would be if each of the centres existed alone are constituted according to the ordinary rule. From these two hypotheses it follows that the equipotential surfaces and the lines of force of the electro-static field are applicable to the speed of the fluid. Thus the formulæ (1) and (2) are generalised and become

$$u = -\,d\,\psi \qquad (3)$$

$$m = \delta\,\frac{d\,\psi}{d\,n} \qquad (4)$$

$$\psi = \Sigma\,\frac{\mathrm{v}}{4\,\pi\,r} \qquad (5)$$

The centres of flow are influenced by one another by their reciprocal reaction so that the flow only takes the direction following the axis of the tubes of force, and has the speed indicated by formula (3). We will take the surface of a conductor; the centres of flow are distributed over it in such a manner that the resulting speed at any internal point whatever is *nil*. The analytical conditions are similar to those of the determination of the superficial electrical density. The equation, $\frac{d\,\psi}{d\,n'} = 4\,\pi\,\sigma$ becomes $\frac{d\,\psi}{d\,n} = v$, calling v the sum of the volumes, v, of equation (5) of the centres of flow scattered over the unit of surface, whence we get

$$v = \frac{d\,\psi}{d\,n} \qquad (6)$$

In order to obtain the speed at a point of the surface very near its outer limit, we have in the same manner to substitute the speed for the electromotive force, whence we get

$$u = \tfrac{1}{2}\,\frac{d\,\psi}{d\,n} \qquad (7)$$

We will consider, in the second place, the part of the field consisting of the dielectric and assume that the centres of flow act at first upon the dielectric in the manner described, until a displacement is produced, which is the limit of action of the incompressible fluid. The equi-potential surfaces and the lines of force remain. Let $d\,\mathrm{s}$, be the section of a tube of force; the speed is $-\frac{d\,\phi}{d\,n}$, the mass which passes through the section during $d\,t$ is, $\delta\,d\,\mathrm{s}\,\frac{d\,\phi}{d\,n}\,dt$. Consequently, the quantity of movement for the time, $d\,t$, is

$$\delta\,d\,\mathrm{s}\,\left(\frac{d\,\phi}{d\,n}\right)^2 d\,t.$$

If we were to suppose the displacement to take place through the whole of the element of volume we should have to give $d\,t$ the value of $d\,n$, and we should get, representing by $d\,\tau$, the element of volume,

$$\delta\,d\,\tau\left(\frac{d\,\phi}{d\,n}\right)$$

for the quantity of movement.

But we admit that the displacement is in proportion to the speed, and it follows that we must calculate $d\,t$ by the equation

$$\frac{d\,\phi}{d\,n}\,d\,t = \mathrm{K}'\,\frac{d\,\phi}{d\,n}\,d\,n,$$

which gives, for the quantity of movement

$$\delta\,\mathrm{K}'\,d\,\tau\left(\frac{d\,\phi}{d\,n}\right)^2,$$

We will now find the quantity of movement for the layer of the dielectric in contact with the conductor. Taking into account equation (7) we get, for this quantity of movement

$$q = \frac{\delta\,\mathrm{K}'}{4}\,d\,\tau\,\left(\frac{d\,\phi}{d\,n}\right)^2, \qquad (8)$$

as we must substitute $\frac{1}{2}\,\frac{d\,\phi}{d\,n}$ for $\frac{d\,\phi}{d\,n}$.

This quantity of movement gives the value of the work developed by the electrical action, *i.e.*, of the energy acquired by the element of volume of the dielectric. This expression is quite in accordance with Maxwell's formula which is

$$\frac{1}{8}\,\frac{\mathrm{K}}{\pi}\left(\frac{d\,\psi}{d\,n}\right)^2 d\,\tau.$$

We have supposed the fluid to remain at rest after having communicated its energy to the element of the dielectric. We should have to double the quantity of movement if, as in the kinetic theory of gases, it assumed an equal and contrary speed.

To find the value of the pressure in the position of equilibrium, we will consider a very small section of the dielectric starting from the surface limit of the displacement. The force should be such that a displacement equal in extent to the section ϵ, gives work equal to

$$\frac{\delta\,\mathrm{K}'}{4}\,d\,\mathrm{s}\,\epsilon\left(\frac{d\,\phi}{d\,n}\right)^2.$$

Thus the force over the unit of surface must be

$$\frac{\delta\,\mathrm{K}'}{4}\,\left(\frac{d\,\phi}{d\,n}\right)^2,$$

an expression which is to all intents the same as that of the electro-static pressure.

We can identify the coefficient $\left(\frac{d\,\phi}{d\,n}\right)^2$ with that of Maxwell's theory by making

$$\frac{\delta\,\mathrm{K}'}{4} = \frac{\mathrm{K}}{8\,\pi} \qquad (9)$$

K′ is the coefficient of linear contraction of the dielectric. According to (9) K is equal to this coefficient multiplied by twice the mass of a cylinder, with radius 1 and height 1.

It is evident that in equation (8), q represents either a quantity of movement or an active force.

ELECTRICITY AS A MOTIVE POWER IN DENTISTRY.*

BY PETER BROWN, L.D.S.

THE question of providing some motive power for the dental engine has led many inventors to investigate the merits of the electromotor in its application to the dental engine. Electricity is coming rapidly to the front as a motive power, and the rapid strides made in its various applications have not been lost sight of by those interested in applying this wonderful agent to various uses in dentistry.

The electromotor has many advantages, strongly indicating it as the only perfect machine for applying power to the dental engine.

Prominent among these is the small space required, comparing it with other motors. As an illustration, it may be

* Read before the Odontological Society, Montreal.

mentioned that a one horse-power motor requires a floor space of only 20 inches square. It can be placed out of sight of the patient; it is noiseless, clean, and requires very little attention.

To dentists living in cities or towns where a supply of electric power cannot be obtained from a central power station, the use of batteries must be resorted to, but it must not be looked upon as a very great objection. Many improvements have been made in the construction and durability of galvanic cells, rendering them much more cleanly and free from unpleasant odors, and less troublesome to keep in proper order, than the form of cell heretofore in use. Batteries can be obtained to-day that will supply for a month or more, without any further attention than the addition of a little water occasionally, all the power required in operating a dental engine.

Where a supply of electricity can be taken from a power station, it may be put to endless uses in the dental laboratory.

With an electric motor properly adjusted to the engine, one may work through the most fatiguing operation with ease. With the foot-power it is necessary, as we know, to stand on one foot while using the engine, which is a very tiresome position in itself, but when the other foot is obliged to work the treadle of the engine, it is doubly tiresome. While with the motor you may take any position the nature of the operation will allow you, and at the end of a long day's work you will look upon the electromotor as one of the greatest boons that modern invention and science have given us.

Another advantage of the electromotor is the perfect steadiness it gives the cutting instrument. There is no swaying of the body as there is when moving a treadle, and it can be run slowly without that decidedly unpleasant jar the instrument receives every time the crank of the driving wheel passes over the centre.

It is maintained by good authorities that one of the best methods of excavating sensitive dentine with a minimum of pain, is by the use of a very sharp burr run at a high speed. Now, in order to get a high speed with the ordinary engine we have to exert quite a little force, and in doing so the body is moved about, and the steadiness required is much disturbed; while with the moter a speed of 2,000 to 5,000 revolutions per minute can be easily obtained by the simple operation of closing a switch, leaving the operator perfectly steady and at rest.

Many will object to introducing the electromotor so near to the chair, saying that it looks too much like machinery; but were there not objections on the same ground made to the dental engine itself on its first introduction, and how many dentists are there to-day without that valuable instrument? When the advantages of the electromotor become better known among the dental profession, there will be few who will be without it.

Then there is the objection of introducing the electric current from a power station into our houses, on the grounds that it is dangerous to life and property. The dangers from this source have been very much exaggerated; the low tension current is not at all dangerous when properly insulated. We have a deadly agent in our houses now in the form of illuminating gas, and serious consequences may result from a leaky joint or improperly closed tap. Yet we do not go about with fear and trembling when we use this agent in our houses. When electric wires are covered with proper insulating material, the fluid they carry is as safely confined as gas or water in their respective pipes. The amount of knowledge required for the successful operation of electrical appliances in dentistry is not necessarily very great. Certainly, a fair amount of information will help one wonderfully out of a difficulty, and will prove valuable in successfully using electricity in practice.

This force is coming into such general favour and use, that everyone should have a little general knowledge of it, which may be easily obtained from one of the numerous text-books on the subject. The time is not far distant when we shall have our houses heated, lighted and ventilated by electricity; the obnoxious gas jet will give way to the clear and steady light of the incandescent lamp, which gives us light with a minimum of heat, and does not vitiate the atmosphere of our rooms, and fill our lungs with carbon. This lamp is to be strongly recommended in making examinations of the teeth, or in operating on dark or cloudy days when the light is unsteady. With proper fixtures the lamp may be made to concentrate its light on the mouth, and also shaded from the eyes of the operator. The incandescent current may also be used to run the electric mallet, the electro cautery; and, applied to a fine platinum point, is the best means of drying out root canals before filling.

THE MECHANICAL ACTION OF ALTERNATING CURRENTS.

A MEMBER of the Russian Physico-chemical Society, namely, J. Borgman, has recently succeeded in reproducing the interesting experiments of Elihu Thomson on the mechanical action of alternating currents in a somewhat different way; and during the course of his researches he has observed several new facts which should not be missed by those who have been attracted to this interesting subject.

The experiments and the facts they elicited are described and discussed at some length in three papers published by Borgman in the *Journal de la Société physico-chimique Russe*, vol. xxii., pp. 130—132, 170—171, and 221, from which we cull the following, which are the chief results.

The alternating current is not indispensable; the same phenomena are produced, but with somewhat less intensity, when a simple intermittent current is employed without ever changing its direction. The presence of the iron core in the coil notably increases the intensity of the phenomena without altering their character.

If upon a vertical coil, traversed by an intermittent or by an alternating current, be placed a cylindrical glass beaker, containing a thin layer of mercury powdered over with lycopodium, then upon the surface of the mercury will be observed two "tourbillons" of opposite character. Any number of these may be produced by interposing under the beaker a disc of copper conveniently cut.

A solution of copper sulphate presents similar phenomena.

By means of a telephone it is possible to demonstrate the existence of galvanic currents in movement in the mercury and the existence of points of the same potential.

If an alternating current be passed through the mercury in the cylindrical beaker from the centre to the circumference, a rotatory movement of the whole mass of the liquid around the centre is observed.

The powdering of the surface of the mercury with lycopodium renders the apparatus so sensitive, that if one wishes, the rotation under the influence of the terrestrial magnetic field and of the current furnished by a Grenet element may be observed.

NOTES ON SOME RECENT PAPERS BEARING UPON ELECTROLYSIS.

THOSE of our readers who like to follow up all the latest developments and applications of electrolysis, even though they may not have an essentially practical bearing, will find plenty of recent papers on the subject. We can scarcely give abstracts of them in these pages, because they are mostly of a chemical nature, and do not bear, except indirectly, upon any particular class of industrial operations.

For example, there is a paper on the electrolysis of metallic thiocyanates, by L. R. Frankel, in the *Chemiker Centralblatt*, 1891, i., 615, which we believe is practically identical with one by the same author which appeared in the *Proceedings of the Chemical section of the Frankland Institute* early in the year. This paper deals with the thiocyanates of mercury, iron, zinc, and most of the more important metals.

In the *Berichte der deutschen chemischen gesellschaft* there is an interesting joint-paper, by F. Kehrmann and N. Pickersgill, on the electrolysis of cobalt salts of oxalic acid (*vide* vol. xxiv., p. 2,324).

The *Transactions of the Royal Society of Edinburgh* contain a paper by Prof. A. Cosens Brown and J. Walker, on the electrolytic synthesis of bibasic acids. A number of these were obtained, and we may note that the electrolysis

was conducted in a large platinum crucible which served as a cathode ; the anode was a stout platinum wire, wound into a spiral, and presenting a surface equal to one-thirtieth of the internal surface of the crucible. This arrangement ensures great current density at the anode, which is shown to be essential to the success of the synthesis. The current employed in these operations had a strength of 3—5 ampères, and an E.M.F. of 12 volts.

Then there is a paper by E. F. Smith in the *Berichte* (xxiv., 2,182), on the decomposition of chrome iron ore by means of the electric current, which, if we remember rightly, is a reprint of a paper in the *American Chemical Journal*. The author shows that the chromium in chrome iron can be rapidly and accurately estimated by his method of procedure.

There is also a paper by the same author and F. Meeher, on electrolytic separations, in the *Berichte*, xxiv., 2,175 ; but those of our readers who do not read German, will find substantially the same paper in the *American Journal of Chemistry*, xii., p. 252, and the *Journal of the Frankland Institute*, cxxix., 239, and cxxxi., 300.

Finally, we may call attention to a paper on a correlated subject in the *Comptes Rendus*, cxii., 793, by A. Joly and E. Leidié.

THE DYNAMOS AT FRANKFORT EXHIBITION.

By W. B. ESSON.

V.

MESSRS. SCHUCKERT & Co. have been already referred to as having had one of the finest displays in the Machine Hall. The Schuckert dynamo was a machine well known in this country ten or twelve years ago, and though in the course of time it has undergone some structural modifications, the type practically remains unchanged. The present machines have, as had the first ones, Gramme-wound flat ring armatures with the magnets lying horizontally on both sides of the ring, while the number of poles ranged in the various sizes exhibited from two to fourteen.

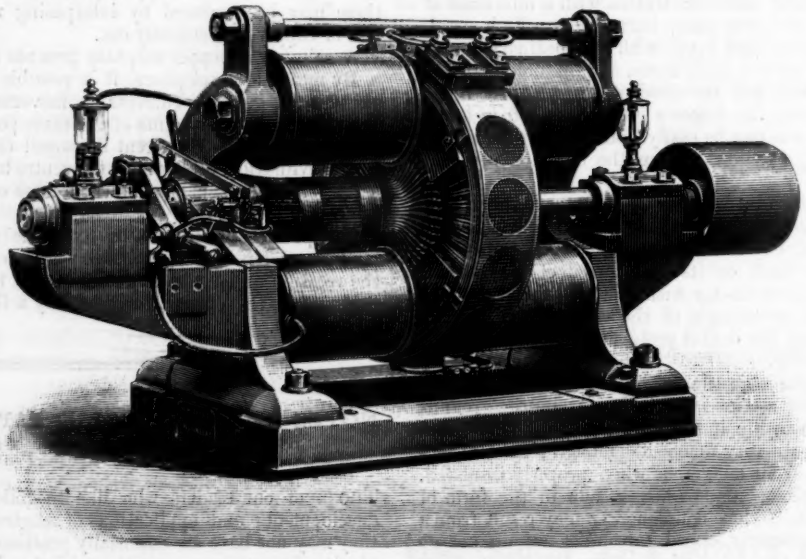


FIG. 24.

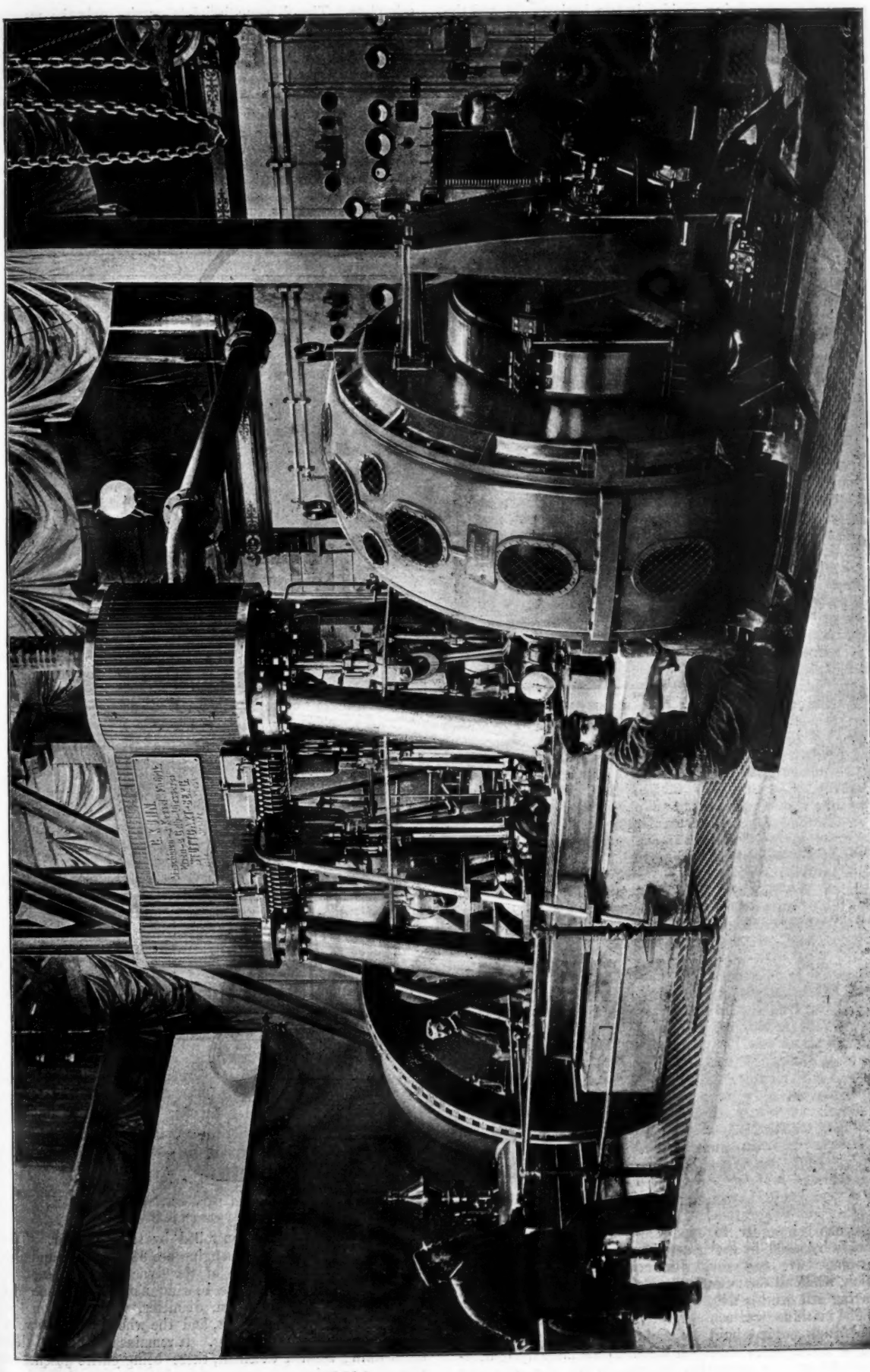
The armature of the flat ring machine has a core formed by winding together on a brass supporting ring a thin strip or ribbon of iron and a strip of paper. Each convolution of the iron strip is thus insulated by paper from its neighbouring convolutions, and the finished core is a laminated flat ring having the planes of lamination parallel to the shaft. During the Exhibition several such cores, ready for insulating and winding, were visible.

In fig. 24 is shown one of Messrs. Schuckert's two-pole machines of recent construction, the magnets being, as in all their two-pole machines, of wrought iron, cylindrical in form and fitted with extended pole shoes. Quite recently this design has been modified somewhat, and the magnets instead of being one above the other, as shown, are in the latest machines placed all on the same horizontal level, the curved yoke pieces being underneath the shaft. With this arrangement the armature can be lifted straight upwards and there is avoided the risk of damage attendant upon its being edged out sideways, as is necessary when the machine is made as in the figure. Both brushes are lifted simultaneously by means of boxwood connecting links.

Fig. 25 shows a flat ring machine with six poles. The magnets of all machines above 15 horse-power and having more than two poles, are now made of cast iron, though there were exhibited some four-pole machines with wrought iron magnets not of the most recent design. The magnets are short, and in section oblong, of about the same proportion as is given by a square placed between two semi-circles. It will be seen that the top half of the frame with its magnets can be lifted right off to afford access to the armature. In all these machines the commutator segments are insulated by cardboard and the segments are cross-connected, so that the number of pairs of brushes used is optional. The connections of the conductors to the commutator are, in every case, made by screws, the wires being thrust into an end hole in the segment drilled parallel to the spindle, and secured by the two screws tightened from the top, easily distinguishable in fig. 25. The two sets of collecting brushes are lifted simultaneously by connecting levers as shown. On the frame of the machine is fitted a tool holder for enabling the commutator to be trued up in place.

But the most interesting feature of Messrs. Schuckert's exhibit was the large direct-coupled flat ring machine shown in the illustration, page 527. This machine, intended to work on a three-wire system with accumulators, is shunt wound and gives 230 kilowatts at a speed of 160 revolutions per minute, the current being 1,000 ampères and the volts at the terminals 230. The armature core is constructed of iron ribbon as already described, the brass foundation ring being secured to a strong cast iron, six-armed, supporting wheel. The armature has a diameter of 240 cm. and it is wound with 1,120 convolutions of a conductor insulated with braided cotton. The commutator has 560 segments and its diameter is about 150 cm. The segments are insulated with cardboard and are, as in smaller machines, cross-connected. Four sets of brushes collect the current and are placed, two sets on each side of the commutator, within easy reach and convenient for the attendant. These brushes are of copper gauze and there are three in a set, each 5 cm. wide. There are 14 magnets on each side of the armature, so the machine has 14 poles and the current flows through the armature conductors in 14 parallels.

The magnets are enclosed in an iron case with which they



DYNAMOS AT THE FRANKFORT EXHIBITION.

are cast, the case being divided in two horizontally, and the halves bolted together as shown. The bottom half is firmly secured to a strong cast iron bedplate, while the upper half is provided with eyes by which it can be lifted right away from the armature. To the bedplate is also bolted a bracket carrying the outside bearing; and to give the structure increased stability, extensions of this are carried upwards and firmly braced to the top half of the magnet casing. As is usual in this type of machine, a thrust bearing is employed and an arrangement is provided whereby the armature can

sole plate. The dynamo bedplate carries only the magnet casing and the outer thrust bearing, while the engine bedplate carries four bearings, one on each side of each crank. The engine cylinders are 46·5 cm. and 68·5 cm. diameter respectively, with a stroke of 45 cm. They are both jacketed and are placed, the low pressure next the dynamo, with the slide jackets between the cylinders and close together. The cranks are at right angles, crank pins and crank shaft throughout being 18 cm. diameter. The steam is admitted to both cylinders by piston valves, the cut-off on

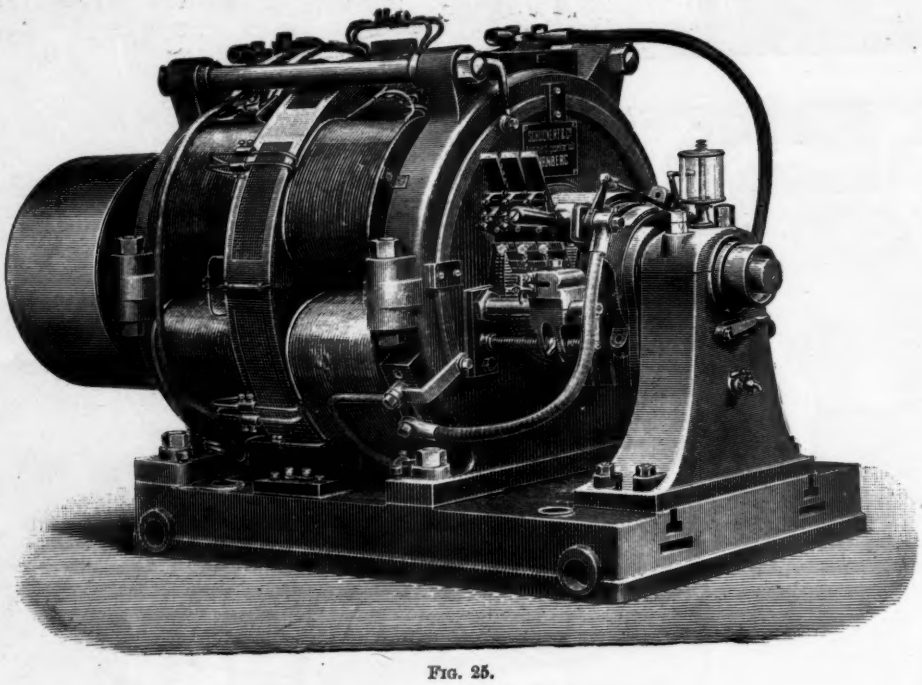


FIG. 25.

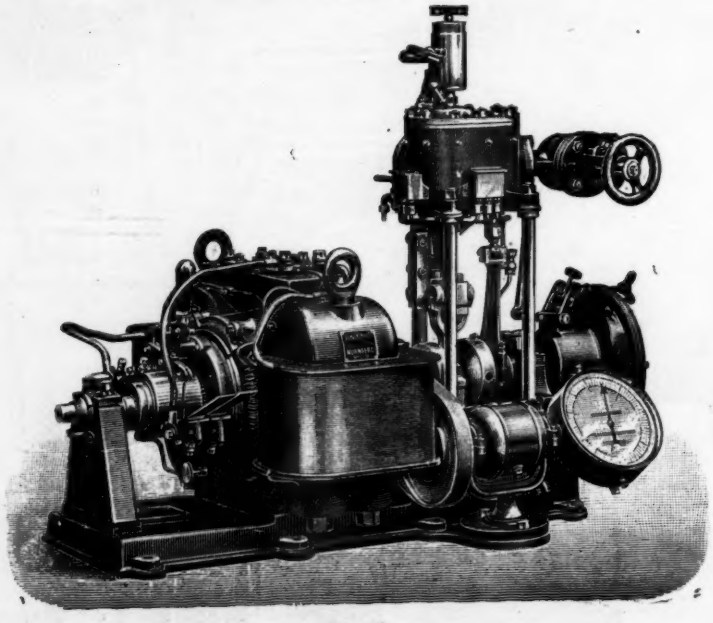


FIG. 26.

be centred in order to oppose any small lateral force not already balanced by the generally symmetrical construction. Openings have been provided in the casing to allow for ventilation, while all the latest improvements in the way of brush-moving and brush-setting arrangements have been adopted.

The machine was coupled to a double crank compound condensing engine, built by Kuhn, of Stuttgart-Berg, but engine and dynamo were each bolted to the masonry foundation without any connection between in the way of a cast

the high pressure being controlled by the governor. The two outside bearings of the engine are 38 cm. long, and the distance between the centre of the dynamo thrust bearing and the centre of the engine bearing next the dynamo was 218 cm. A flywheel, 270 cm. diameter, was placed on the outside end of the crank shaft, and the whole formed a very admirable piece of engineering. It remains to be added that the working seemed excellent, there being entire absence of vibration or noise.

For lighthouse work and ship lighting, Messrs. Schuckert manufacture a machine of the Manchester type, and in fig. 26, one of these is shown coupled direct to a quick running vertical engine. It will be seen that the combination is very neat and compact.

Messrs. Schuckert show several motor-dynamos, which consist of two upright double magnet Gramme-wound machines coupled together, also some motor-dynamos for multiple currents of rather peculiar construction. These latter are the direct current, flat ring machines of Schuckert, just as they have been described and illustrated, but with the addition of insulated contact rings, mounted concentrically on the shaft, from which alternating currents may be also collected. On the particular six-pole machine examined, there were two pairs of such rings with collecting brushes to correspond. Wires from one pair were led to two opposite points of the armature winding, while from the second pair were led wires to two other points, also opposite, but at right angles to the first two. On driving such a machine we get from the ordinary commutator a direct current, and from the contact rings, two alternating currents differing in phase by 90°. Obviously the machine may be used in a variety of ways. We may drive it as a dynamo, and take from it a direct or alternating current or both; we may take from it a direct or two alternating currents or both. We may drive it as a motor by direct current, and use part of the energy mechanically, by belting something to the pulley, while taking the balance out in one or two alternating currents. Or we can drive it as a double phase motor by two alternating currents, taking from it mechanical power or direct currents. It is, in fact, rather a striking appliance, seeing that only one armature is used. At first sight one is inclined to think that there will be sparking on the direct current brushes when any considerable current is flowing through them, owing to the disturbance caused by the alternating currents; but as the writer was assured nothing of the kind happens, and this was proved by some rough experiments made at Messrs. Paterson and Cooper's works a few weeks since. In the latter case an ordinary 150-light compound Phœnix dynamo was fitted with two pairs of rings from which wires were led to four equidistant commutator segments. The machine working in the ordinary way gave at 1,180 revs. per minute :—

Amperes	0	12·5	20·5	36·0	65·8	74·7	90·0
Volts	95	99	102	102	102	102	102

With an alternating current taken from one pair of the rings, the direct current being still taken from the terminals in the ordinary way, the readings were at the same speed :—

Direct.		Alternating.		Direct.		Alternating.	
Amps.	Volts.	Amps.	Volts.	Amps.	Volts.	Amps.	Volts.
0	95·0	0	68·2	77·0	99·0	30·0	74·0
0	85·0	30·0	58·0	86·5	100·0	30·0	75·0
16·0	92·0	30·0	65·2	92·5	100·5	30·0	75·0
27·0	93·0	30·0	67·5	38·0	94·0	58·5	63·0
36·0	94·0	30·0	69·0	49·0	101·0	32·4	72·0
42·5	96·0	30·0	70·5	54·0	96·5	52·4	68·0
49·0	97·0	30·0	70·5	60·0	99·0	36·5	72·0
71·0	98·5	30·0	74·0	79·0	100·0	31·0	74·5

On current being taken from both pairs of rings, the observations, with the machine still running at the same speed, were :—

Direct.		Alternating, No. 1.		Alternating, No. 2.	
Amps.	Volts.	Amps.	Volts.	Amps.	Volts.
0	70·3	32·0	51·5	32·0	50·5
16·0	86·0	32·0	64·5	32·0	63·0
29·0	89·0	32·0	66·5	32·0	66·0
43·0	91·0	32·0	69·0	32·0	70·0
57·0	94·0	32·0	72·0	32·0	71·5
63.0	95·0	32·0	71·5	32·0	72·0
70·0	95·0	32·0	71·5	32·0	71·5

These were the results when the machine was running as a dynamo, and sparking was practically absent throughout the experiments. The figures give some general idea of the effects the currents have on each other, and are the first of the kind published or, for all the writer knows, obtained in this country.

(To be continued.)

[ERRATUM :—Article IV., page 502—transpose the words "keyed" and "fixed" in third and fourth lines from the bottom.]

ELECTRIC TRAMWAYS WITH OVERHEAD CONDUCTORS.

BY A. RECKENZAUN.

DEAR old Boston, the reputed American centre of literature, culture and refinement, has also become the centre of electrical science. If any city in the United States raised the cry against overhead conductors in streets it was Boston, or rather its æsthetic inhabitants. Three years ago the "hub of the universe" had not a single mile of electric railways within the city boundaries, and now upwards of 400 electric cars run through its streets, requiring some 180 miles of overhead wires, including feeders, for their propulsion, and 250 more cars will be put upon the roads within the next few months. From the electrical point of view, Boston is at present the most interesting city in the United States. Overhead conductors running parallel with the streets, strung upon ornamental posts, are not nearly so ugly as most people, who have not seen them, would imagine. There are many uglier things in large cities which are not objected to because the people are accustomed to see them. No one objects to lamp posts, no matter how ugly they may be, and why should we condemn poles carrying trolley wires which are ornamental, in some cases even handsome; and when these same poles are used for carrying well-shaped arc lamps, then we may indeed regard them as an improvement. Supposing, even, that two or three really beautiful roads or avenues do not benefit by having such poles, there are in most cities dozens of streets which are positively improved by this light and power-giving innovation. That the inhabitants of Boston have taken kindly to the system is evidenced by unmistakable statistics. According to the monthly *Bulletin* for September, issued by the Thomson-Houston Electric Company, the average net earnings per electric car mile on the West End Street Railway were 16·58 cents; the average net earnings per horse car mile 10·71 cents, giving a gain of 5·87 cents of the electric over horse traction. These averages extend over five months. The ratio of electric earnings over horse car earnings was therefore nearly 55 per cent. The electric cars are handsomer, more comfortable, and run faster than the horse cars, therefore the public patronise them. The electric cars involve between 30 and 40 per cent. less operating costs, therefore the shareholders and directors of the West End Street Railway like them better than horse cars.

Let us look nearer home—to the continent of Europe. For seven long years there were only two important electric tramways with overhead conductors, viz., one at Frankfort, in Germany, and the other at Moedling, in Austria; both have worked, and are working satisfactorily. These are suburban lines, however, and no decided move has been made in the direction of carrying overhead conductors through the heart of a city until the early part of this year, when the ancient historical city of Halle, in Germany, opened its electric tramway, the work of the Allgemeine Electricitäts Gesellschaft of Berlin. The ever-courteous director of the A.E.G., Mr. Emil Rathenau, told me some interesting stories anent the early development of this enterprise, and about the struggles with the German Government on account of the interference with the working of telegraph and telephone circuits due to induction. As reported at the time in the ELECTRICAL REVIEW, the Allgemeine Electricitäts Gesellschaft came out triumphant; the Courts decided that the streets of a city belonged to the people and its traffic, and the Government had to remove its wires beyond the influence of the electric tramway circuits. The line in Halle is built in three sections, all having their terminus at the Central Bahnhof, and aggregating 4·84 miles in length. During the month of August 20 electric

cars made 46,040 miles, giving an average of 76·73 miles per car per day. The revenue for that month was £955, and the gross expenditure £467, giving the exceedingly favourable ratio of 48·9 per cent., as a set-off against the cost of horse traction which usually amounts to at least 75 per cent. of the revenue. The entire cost of equipment of 25 cars, central station, overhead conductors, &c., was £30,000, giving an average of £1,200 per car inclusive of every charge. At Halle the posts are of very light construction, built of wrought iron lattice work, and there is absolutely nothing objectionable about the appearance of the whole line.

Visitors to Frankfort-on-the-Main who have seen the electric tramway running from the exhibition to the Opera Platz were almost unanimous in their opinion that the system shown there by Messrs. Siemens and Halske would not disfigure the most beautiful city. In this case the number of span wires usually necessary at curves was avoided by the rod on the top of the car being provided with horizontal arms so as to follow the deviations of the straight wires from the curvature of the rails.

Thanks to the praiseworthy exertions of Mr. Graff Baker on behalf of the Thomson-Houston Electric Company, and to the liberal-minded Mayor and Corporation of Leeds, not forgetting the chairman and members of the Highways, Sanitary and Building Clauses Committees, the Town Clerk, Borough Engineer and their officials, thanks to all these gentlemen, we have now in England an electric tramway with overhead conductors, which is likely to be the forerunner of many similar undertakings. They deserve our best wishes for continued success. Reference is made in detail to the opening ceremony and construction of the Roundhay Electric Tramway in another column. I am sure the posts and overhead conductors along Roundhay and Harehills Roads are far less unsightly than the two-storey cars moved by steam locomotives through the streets of Leeds.

Whilst the last-named line was in course of construction Mr. Curruthers Wain, the indefatigable chairman of the South Staffordshire tramways, moved the local authorities, and obtained a favourable ear from the corporations along the route, so that in the course of next year we may see one of the most important tramways in the United Kingdom running by electricity from overhead conductors. The South Staffordshire tramways have been using steam locomotives from almost every maker in the world. They have made most strenuous efforts to make the lines pay, and they have introduced all the best engineering skill to render steam traction successful, nevertheless the gross expenses amounted to nearly 90 per cent. of the revenue. The steam locomotives are practically worn out, and the directors are not inclined under the circumstances to renew them.

To go back to horses would be almost as bad. Now they are going to give electricity a chance, and with this they will undoubtedly succeed, provided that the necessary care will be given to constructive details, and on this point we need not fear, if the rumour is correct that the Electric Construction Corporation has obtained the contract to equip these lines. Almost without exception, the earnings of electric cars are higher than those of horse cars, for reasons already stated. The earnings of the South Staffordshire Tramways are by no means below the average, but if the same are increased, as they are sure to be with the better accommodation and service, and if the working expenses are materially reduced, as has been the case with nearly all old tramways when converted into electric ones, then brighter prospects are in store for this undertaking, and good dividends may be expected, in spite of the additional capital which has to be invested for the purposes of conversion. Mr. Alderman Newman, Deputy Mayor of Walsall, informed me that it had been suggested that the posts for the overhead conductors on the Staffordshire lines shall be 25 feet high in order to clear the fire escapes, also that the same posts will probably be used for street lighting; in narrow streets, wherever permission can be obtained from owners, the span-wires will be attached to houses; the maximum speed in populated streets is to be eight miles an hour.

The signs of the times just now are in favour of electric traction with overhead conductors; the system has been eminently successful, and it has proved itself the most economical in every respect. It is the most suitable at the present moment, and public opinion is bound to further its own interests.

ELECTRIC LIGHTING AT PORTSMOUTH.

THE low tension system of electric lighting which has been under consideration of the Electric Lighting Committee of the Portsmouth Town Council has been abandoned on account of its great cost. It will be remembered that last month a scheme was laid before the council and adopted, in which the cost of lighting was estimated at £60,000. These figures were based on a report received from Mr. Shoolbred, who was consulted by the council, and who strongly recommended the low tension principle. More recently an alternative scheme was pointed out to the committee by which a saving of one-third would be effected. Prof. Garnett's opinion has been obtained, and as a result of their investigations the committee have decided not to adopt Mr. Shoolbred's scheme. It has been pointed out that in a more compact town the low tension scheme would be all that could be desired, and its safety is unquestionably greater than any other; but in a scattered place like Portsmouth the cost of the installation would not allow any profit to be made. It would be economical only (on the two-wire system) for a distance of 700 yards.

The matter will now remain in abeyance until the committee has been re-elected or reconstituted. It seems probable, however, that a proposal submitted by Prof. Garnett may be favourably considered, by which a high-tension alternating system would be adopted so far as the mains are concerned. In order to ensure perfect safety with this, the mains would not be tapped, but transformer sub-stations would be provided at which the E.M.F. of the current would be reduced for distribution to private customers and for street lighting purposes.

THE ROUNDHAY ELECTRIC TRAMWAY.

AT the Ninth Annual Convention of the Street Railway Association of the State of New York, Mr. John N. Beckley, President of the Rochester Railway Company, read an interesting paper in which occurs the following passage:—"We find in some communities so great a prejudice against overhead wires that railroad companies are unable to obtain the necessary franchises and privileges, the granting of which would result in giving to those communities the benefits of rapid transit with electricity as a motive power. Hour by hour, however, experience is teaching all doubtless, that the problem of rapid transit for cities has been solved, and that the trolley has come, and come to stay. We know that in every locality where the electric railroad has been properly built and is properly operated, the people are enthusiastic in its praise, and that the proposition to go back to the system formerly used would meet with universal condemnation."

Electric Railway Engineering has become an art which is only thoroughly understood by those who developed it—by those who work at it daily. We have only to compare the present motor truck with that of four or five years ago. People then had an idea, and this notion seems still to be shared by the writer of a leading article in our esteemed contemporary, the *Engineer*, of October 30th, that the equipment of an electric car consists of some sort of "high-speed motor, placed beneath the car, and this causes the rotation of the carrying wheels, gearing being interposed to reduce the 900 or 1,000 revolutions per minute of the motors to the 100 revolutions or so per minute of the car wheels. *The electricity, having done its work, goes to earth through the rails.*" (!) If the writer of these sentences had gone down to Leeds, he would have seen some excellent mechanical engineering applied to the handsome cars of the Roundhay Electric Tramway, which was opened by the Mayor of Leeds on the 29th ult. The trucks, constructed by the Thomson-Houston Electric Company, are models of mechanical engineering, the outcome of long experience and serious study. Every detail is designed and constructed to withstand the compound strains to which a tramcar is subjected; the nature of which is best known to the pioneers of electric and steam traction on tramways. The layman has not the faintest conception of the requirements peculiar to tramway propulsion, unless

he has carefully followed the evolution of the tramway motor and its truck to its present stage of development.

The motors on the Leeds cars are capable of giving 15 H.P. each; there are two axles, each being driven by its own motor through spur gearing enclosed in an oil-tight box. The ratio between the motor's speed and the car axle is 4·5 to 1, therefore when the car runs at the rate of 8 miles an hour, the armature of the machine makes only 366 revolutions per minute; the diameter of the car wheels being 33 inches. In consequence of this low speed, carefully cut teeth, and the oil casing surrounding the whole gearing, a silent motion is obtained, and the durability of the pinions and spur wheels is greatly increased.

One end of the motor is supported by bearings upon the axle, and the other end is suspended upon a spring which prevents sudden shocks to the gearing at the moment of starting. The motor, also, is protected from dirt by a casing. The speed regulation is effected by means of resistances placed underneath the car. Owing to the low armature speed the motors are necessarily heavy, 2,060 lbs. each; the gearing weighs 215 lbs., giving a total of 4,550 lbs. for the propelling apparatus alone. It has been found in practice that the doubling of the motor weight and the attending reduction in the armature speed has increased the durability of the apparatus enormously, and thus reduced the repair bill in a far greater ratio than the slight increase of power due to the greater weight of the car. Six cars were placed upon the road last week, and they worked admirably, the only hitch which occurred during the opening ceremony being caused by the overheating of the crosshead of the steam engine at the central station. This was not to be wondered at, for in the first place the engine had never been tested at its maximum load, and secondly, all the cars were started simultaneously upon a severe gradient, a test which would never occur in every-day working. Several of the cars were loaded beyond their intended capacity, and we have calculated that the starting effort at one moment must have exceeded 200 electrical H.P., whilst the steam engine is only rated at this power, and our figure gives no allowance for the conversion of mechanical into electrical energy, and *vice versâ*, nor of the loss in electrical transmission. This incident, although it damped the enthusiasm of the general public, gave a proof of the enormous flexibility of the plant, for there was no damage done, and the cars eventually completed their return trip in excellent style.

The power station is within a short distance from Harehills Road at its junction with Beckett Street, and is a temporary structure of corrugated iron 85 feet long by 36 feet wide. It contains the boiler room, engine room, and small workshop. Steam is generated by a 192 H.P. Babcock and Wilcox water tube boiler, built at Glasgow; it is fitted with feed water heater and a mechanical stoker of a new design. The engine room is divided from the boiler room by a brick wall, and contains a Macintosh and Seymour single cylinder (18 inches by 18½ inches) high speed engine, which drives by belts two 62-unit Thomson-Houston dynamos at 900 revolutions per minute. A very handsome ornamental switchboard with the necessary switches, instruments and cut-outs, completes this apparently simple installation.

The line of tramway, extending from the junction of Roundhay and Chapeltown Roads to the new entrance to Roundhay Park, was completed in August, 1889. On May 15th of the present year it was leased to Mr. Graff Baker for a term ending October 31st, 1892, for the purpose of showing the Thomson-Houston system of electric traction, and giving the corporation and the people of Leeds an opportunity of convincing themselves of its practical value. The total length of tramway at present operated electrically is 3½ miles, comprising 2 miles of double line, and 1½ miles of single line. It contains gradients of 1 in 20 for a distance of a quarter of a mile, and of 1 in 21 for a similar distance, besides lesser gradients and various curves. Altogether this tramway presents most of the conditions which make horse traction difficult and often unprofitable.

Steel rails weighing 98 pounds to the yard are used throughout the line. They are laid upon a solid bed of concrete 18 feet wide and 9 inches deep. They are tied together at short intervals by tie rods. Copper wires of ·34 inch diameter (No. 0 B.W.G.) have been laid between each pair of rails upon the concrete bed, forming the return circuit to the dynamo terminals. This return wire is joined in two places to each rail by short lengths of copper wire (No. 7 B.W.G.), which pass through holes in the web of the rails, and are keyed fast by pins. By this means the rails form part of the return circuit.

The current is carried to the overhead conductors by means of a No. 0 B.W.G. copper "trolley wire," supplied by Messrs. Glover & Co., of Manchester. It runs from the positive terminal of the dynamo to the centre of the tracks, and is supported upon insulators attached to span wires stretching across from post to post. The span wires are of galvanised steel, No. 5 B.W.G., securely fastened to insulators on the tops of the poles. These poles are 21 feet 6 inches high, 6 inches diameter at the base, and 4 inches at the top; they consist of three lengths of mild steel tubes. The "trolley" wire conveying the current to the motors is connected in convenient places to "feeders," which are insulated copper conductors carried upon the poles.

The engine, dynamos, measuring instruments, cars, motors and gearing, are all of American make, even the car-drivers (motorneers), we believe, are Americans.

After a general inspection of the cars and the generating station the party was conveyed in waggonettes to the Leeds Town Hall, where an excellent luncheon (at 5 p.m.) was served. The Mayor of Leeds, Mr. Alf. Cooke, presided, and he was surrounded by a large number of provincial mayors, aldermen, town clerks, borough engineers, tramway directors, and others. Among the guests from London were Mr. Carruthers Wain, President of the Tramways Institute of Great Britain; Prof. George Forbes, Mr. J. G. B. Eliot, Secretary of the Tramways Institute; Mr. Henry Edmunds, Mr. A. Reckenzaun, Mr. C. H. W. Biggs, and Mr. Holroyd Smith. Mr. Graff Baker was unfortunately too ill to attend the opening ceremony, and Mr. J. E. Winslow, the Manager of the Roundhay Electric Tramway, acted in his stead in the most amiable manner, giving every information one could desire, and with great clearness. Everyday traffic was to commence in the course of this week, and we feel sure, from what we have seen, that the tramway will prove entirely successful.

Perhaps Mr. Beckley's assertion at the recent New York convention that "the trolley has come, and come to stay" will soon be re-echoed by English tramway directors and local authorities.

OBITUARY.

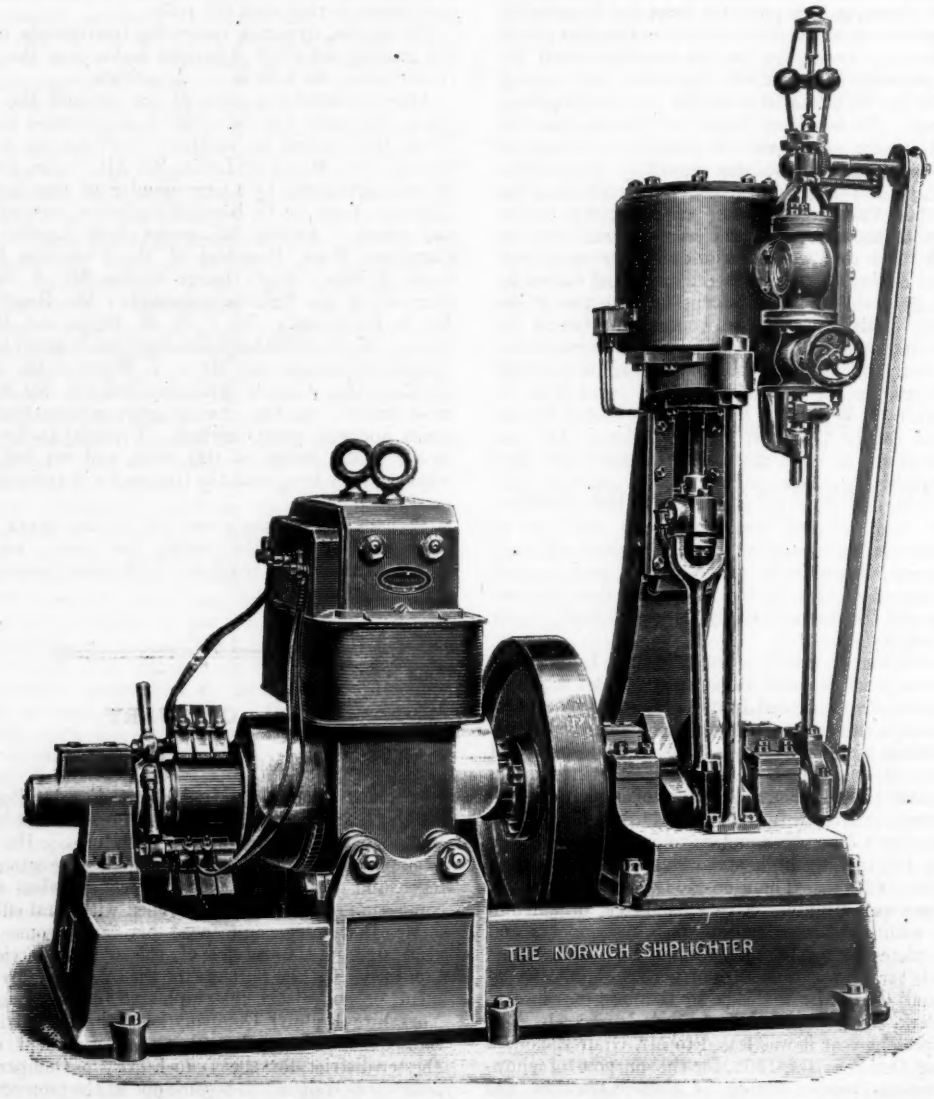
MR. W. F. BOTTOMLEY.

THE many friends of Mr. William Fereday Bottomley will hear with regret of his death, which occurred at his residence, Booterstown, Dublin, on the 30th ulto. He had only a week previously passed the crisis in a severe attack of typhoid fever, and was on the road to recovery when an attack of congestion of the lungs supervened with fatal effect.

Mr. Bottomley commenced his career some thirty-seven years ago in the service of the old Magnetic Telegraph Company. On the purchase of the telegraphs by the Government, he joined the telegraph staff of the Lancashire and Yorkshire Railway Company with the late Mr. Warburton. Subsequently, he undertook the management of the Manchester district for the Indo-European Company, which he afterwards resigned to become one of the pioneers of practical telephony, and it was under his supervision that probably the first telephonic trunk lines in this country were erected. These were between Manchester and Stockport and Manchester and Oldham, and in this connection it is interesting to note that in these lines the now well known "twisted wire" system, of which Mr. Bottomley, the late Mr. Charles Moseley, and Mr. W. E. Heys were the joint patentees, was first employed. As manager for Mr. Moseley, Mr. Bottomley, by his pleasant and interesting public lectures, popularised the telephone in his district at an early date and made the success of a telephone exchange, which Mr. Moseley was about to establish, a foregone conclusion. So convinced were the directors of the late Lancashire and Cheshire Telephone Exchange Company of the danger to them of this opposition, that, before a mile of line was erected, they interposed and bought up Mr. Moseley's rights and property.

Mr. Bottomley then joined the National Telephone Company as their London superintendent, but a few months afterwards the resignation of Mr. Butterworth having left the management of the Dublin Telephone Exchange vacant, Mr. Bottomley was appointed to the office which he held and filled with great success until his death.

At the commencement of his career he quickly gained the confidence of his chiefs, and being one of the most expert operators of his day, he easily won his way upwards, and it is highly probable that had he had the high educational advantages which some of his colleagues possessed, his sound judgment, energy, and genial manner would have won for him a still more distinguished place. Mr. Bottomley died at the comparatively early age of 51, and leaves a widow and several children.



SHIP-LIGHTING PLANT.

OUR illustration represents one of Messrs. Laurence, Scott and Co.'s shiplighting plants, S L 5 type. The output of the one illustrated is 140 ampères at 65 volts, at 260 revolutions per minute.

The engine is well and substantially built, with very large bearing surfaces and ample lubricating arrangements, but otherwise calls for no special mention.

The weight of the dynamo field magnets is taken through brass packing pieces on two strong ribs that run across from one side to the other of the bedplate, whilst they are held in position by means of the Muntz metal studs coming through the strong brackets on the side of the bed-plate, circular brass distance-pieces being arranged between these brackets and the magnet poles. A very rigid effect is thus secured.

The armature of the dynamo is of Laurence, Scott & Co.'s usual type, the conductor being wound in slots milled into the plates which form the armature core. These plates have hexagonal holes into which the hexagonal steel shaft is driven with insulating pieces; so that the mechanical arrangement is exceedingly good, and the armature will stand an amount of rough usage and hard work that would be fatal to many other kinds.

It is said to be absolutely necessary, if an armature of this kind is to be successful, that the opening between the projections and the periphery of the armature, *i.e.*, practically the width of the slots, should not exceed a certain amount. In practice, it is found that it should not be more than twice the clearance between the armature and the pole pieces. In the commutator of the above machine there are 110 sections, one length of conductor to each section, but there are only 55 slots cut in the armature, each ·355 inch wide. This would be an excessive width, but in winding, each slot is made into two by means of three longitudinal strips of charcoal iron running the whole depth and length of the slot, but insulated from both the conductor and the armature core. These strips reduce the width of each slot to ·14 inch, and thus make the outside surface of the armature sufficiently even magnetically, to entirely do away with the heating of the pole-pieces and noise that would have been caused by the wider slots.

The armature of the machine is $13\frac{1}{2}$ inches diameter outside, $11\frac{1}{8}$ inches at the bottom of the slots, and is 9 inches long. It is wound with four parallels of No. 13 wire, braided.

The magnets call for no special mention. They are of Lowmoor iron, and have a sectional area of 85 square inches. The ampère-turns in the shunt are 9,370, and in the series 7,840.

The plant illustrated was worked up to 200 ampères for six hours before leaving the makers' works. Even with this very excessive load there was no sparking, and the rise of temperature in the armature at the end of the test was only 80° Fahr.

The makers have recently obtained a licence from Mr. Gisbert Kapp to use his patent end connections for strip armatures, and these will be used in all the large machines.

THE LINK SWITCH.

THE necessity for a standard and reliable electric light switch has been fully recognised by electrical engineers and that section of the public which is keenly interested in the attainment of the *ultima thule* of electric lighting, namely, trustworthy appliances which never get out of order. Notwithstanding the constant demand for such a perfect switch, and despite the fact that patents and specialities are numberless, the conditions have as yet been imperfectly fulfilled. One of the nearest approaches hitherto made to combine efficiency with economy of construction, which has deservedly met with the approval of the users, is generally known as the "Tumler" switch, actuated by a rocking lever which depresses an insulated contact bar, pivoted at one end, against the force of a spring. The contact pieces or brushes are electrically connected by the metallic end of the contact bar when it is depressed. When the rocking lever is turned in the opposite direction the elasticity of the spring raises the contact bar and breaks the circuit. It is obvious that if the spring becomes injured, or the contact bar should stick, the circuit cannot be broken by any movement of the rocking lever. Here is a serious disadvantage which, in many cases, may be productive of much harm. A new switch of this particular type, but constituting a distinct improvement upon the "Tumler" switch, and obviating all the disadvantages thereof, has been brought out recently by the General Electric Company, Limited, and patented by Mr. G. Binswanger, which we will briefly describe.

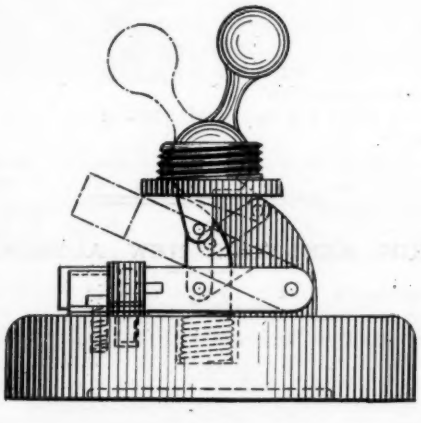


FIG. 1.

Fig. 1 is an elevation of a small "Link switch" with the protecting cover removed. The rocking lever is pivoted to a bracket attached to the base, and the contact bar pivoted at one end engages with the contact pieces or brushes when the switch is in the "on" position. A cam piece, or extension of the rocking lever or handle, is connected to the contact bar by a link which is jointed to both. The spiral spring is placed under the contact bar, so that when this is depressed by the cam and link it is locked, owing to the joints of link and the thrust of the spring being in line. The dotted line shows the "off" position, and it is obvious that the connection of the contact bar with the rocking lever, by means of the link, enables the movement of the rocking lever to *mechanically* raise the contact bar out of contact, independently of the action of the spring, or the retardation caused by sticking of the contacts. Fig. 2 is an elevation of a double pole or multiple contact "Link switch" in which the contact bars are connected to the link and cam by a transverse bar rigidly attached to all the bars. A modification is shown by the sectional elevation, fig. 3, in which the cam or handle presses down the contact bar, and the link is *not* jointed to it, but is jointed to the contact bar, and works freely within a slot in the lever handle, a stop preventing it from becoming disengaged. Ordinarily this link is inoperative, since the spring alone raises the contact bar when the rocking lever is thrown over. Should the spring fail to act properly, or the contacts adhere beyond its lifting power, the stop engages with the edges of the slot in the lever handle, and the contact bar is raised mechanically, as in the instances already cited. The end of the contact bar is made of solid brass, and wedged in firmly between the two contact brushes, thus ensuring excellent and solid contact being made.

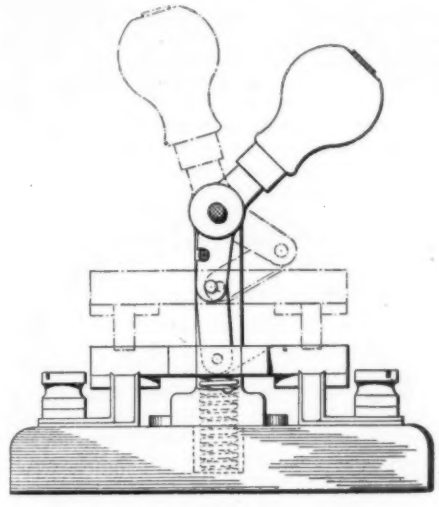


FIG. 2.

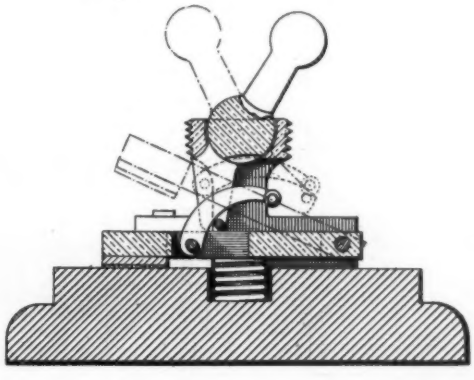


FIG. 3.

It will be seen that the mechanism is extremely simple and not liable to derangement (we may here add that we have given a specimen sent to us a severe trial of its soundness without our faith in the manufacturers' assertions being shaken), while the mechanical action ensures the proper and effective working of the switch.

We understand that the General Electric Company, Limited, is manufacturing the "Link switch" upon the principle above described in various forms and sizes and with different modifications to suit every requirement incidental to electric lighting or power that may occur within any possible range of current.

POLYPHASED ALTERNATE CURRENTS.

(Continued from page 502.)

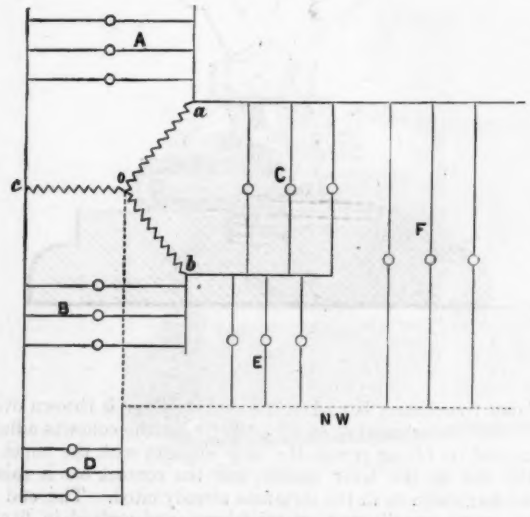
IV.—APPLICATIONS.

THE applications of the electric current may be classed into three essentially distinct groups, according to the nature of the transformation effected by the apparatus employed for its utilisation. These are: 1. *Thermic* applications in which the electrical energy is transformed into heat; this class includes electric lighting; 2. *Mechanical* applications, and 3. *Electro-chemical* applications. But in these last applications simple ordinary alternating currents or polyphased currents cannot render great service in their natural form. They require to be first transformed into continuous currents, and thus we shall have to describe, in view of those applications of the future, which may require the employment of continuous currents, some apparatus which effect this transformation very simply.

ELECTRIC LIGHTING.

In the Lauffen-Frankfort experiments the lamps used were exclusively incandescence lamps. It is probable that the feeding of arc lamps would involve certain difficulties, either through the self-induction of the regulating mechanism of these lamps, which tends to destroy the equality of the lagging of the three currents or through the complex and ill-defined phenomena of which the arc is the seat, or, again, because the low frequency of the currents employed is detrimental to the steady lighting of objects to which a somewhat rapid movement is imparted; this inconvenience is familiar to us since the first experiments with the Jablochkoff candles. Up to the present only incandescence lamps have been used for electric lighting to the exclusion of arc lamps.

If we consider a triphased generator in which the "star" mode of coupling is used, we can see that it is possible to arrange derivations from it in *six* different ways, *three* by connecting the lamps between any two wires: *a* and *b*, *b* and *c*, *c* and *a*, *three* by connecting them between the neutral wire, *o*, and each of the three other wires: *a* and *o*, *b* and *o*, *c* and *o* (fig. 1).

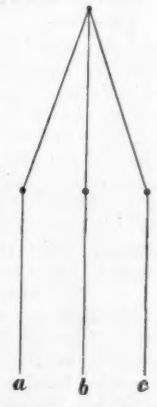


Incandescence lamps coupled on star-triphaser; A, B, C, are groups of lamps on high voltage; D, E, F, are low voltage lamps connected between the N W (neutral wire), and any of the other three wires.

FIG. 1.

The difference of potential between any two wires being, as we showed in a former article, 1·732 times as great as between the neutral point and any one of the wires, the lamps connected in parallel should have voltages in the same ratio, according to the points between which they are connected. From the point of view of the independence of the three circuits and the possibility of varying to a certain extent the number of lamps supplied in the three groups constituting the connection of each system, it is better to connect the lamps between the neutral wire and each of the three other wires. In the case in which the three groups give exactly the same intensity, we can easily see that no current passes into the neutral wire, the function of which is simply to compensate the inevitable inequalities of output that occur in practice. Each of the three cores of the three-branched transformer works for its own circuit, and the system, as far as incandescence lamps are concerned, may be compared to three independent transformers connected by a common return wire, but the phases of which lag by a third of a period. Thus, for each group of lamps in service, two wires will be sufficient, one connected to the neutral wire, and the other to the extremity of one of the three bobbins of the generator or transformer.

As a scientific curiosity, M. Dolivo-Dobrowolsky showed us at the Frankfort Exhibition an incandescence lamp at work with three filaments arranged as shown in fig. 2. To



Coupling of a three-filament lamp on the three wires A, B, C.

FIG. 2.

any one unacquainted with the properties of polyphased alternate currents, it is somewhat puzzling to see a lamp with three filaments of equal section and equal length arranged in derivation on the three wires connected by their other extremities and traversed by equal currents. In order to understand this phenomenon, we have only to remember that if the *effective* intensities are pretty equal in the three filaments, they are *unequal* at each instant, and that each of the wires serves as a common return wire for the current passing at the same moment through the two others. It is not probable that an important practical application will ever be made of such lamps, but it was very interesting to note their curious properties.

We will study the important question of *motors* in our next article.

E. H.

RANKIN KENNEDY'S NEW ALTERNATOR.

THIS alternator belongs to that class in which both the exciting and the generating coils are fixed, the revolving part consisting of laminated iron inductors. Machines of this class have been made by many inventors, such as R. Knight, Wheatstone, Henley, and lately by Kingdon on a large scale.

The points of novelty in this new machine are chiefly the arrangement of the coils of wire and the construction of the magnetic circuits, whereby only two exciting coils and only two generating coils are required in the machine, however large it may be made and however great may be the pressure and frequency of the alternating current required.

The machine very much resembles a transformer in its parts and is about as simple in construction. The iron field magnet portions surround the copper coils, which are simple rings of insulated wires; the inductors are carried on gun-metal wheels, and in revolving alternately, open and close the magnetic circuit round the copper coils, thus inducing current in them.

There is no reversal of magnetism in any part of the operation of the machine, only a simple rising and falling of the magnetic flow without reversal.

The iron is made of very ample sections, so that at no part of the magnetic rise is the density of the flow above the knee of the characteristic curve of magnetic permeability of the iron. And the magnetic flow never falls to zero, in fact, the machine may be said to work on the nearly straight rising portion of the curve of magnetism. The magnetising force is steady, but the magnetic resistance varies with the position of the inductors, and so accordingly does the magnetic flow, thus, if the magnetising force is represented by 1,500, and the magnetic resistance when the inductors have closed the magnetic circuit, is equal to 2, then the flow of magnetism will be equal to 750. Then, on open circuit, the magnetic resistance may be 100, or say 50, then the flow can only be 30, so that we have a rise and fall equal to $750 - 30 = 720$ lines of magnetic flow; then according to Kapp's formula we get with 600 revolutions per minute and six inductors on each side, $E = 6 \times 600 \times 720 \times 10^{-6} = 2{\cdot}6$ volts per turn of wire on the generating coil; these figures are hypothetical, taken to show the principle of this machine. In a machine recently built and here illustrated, the E.M.F. was 8 volts per turn of generating coil; the speed 750; the exciting current 15 amperes × 35 volts; the inductors six on each side; the total pressure was 2,400 volts with 300 turns of wire on generating coil; the output was 24,000 watts.

Fig. 1 is a perspective view of the machine; fig. 2 is a perspective view of the inductors on the shaft; fig. 3 is view of one pair of coils, and fig. 4 is a view of one of field magnet blocks.

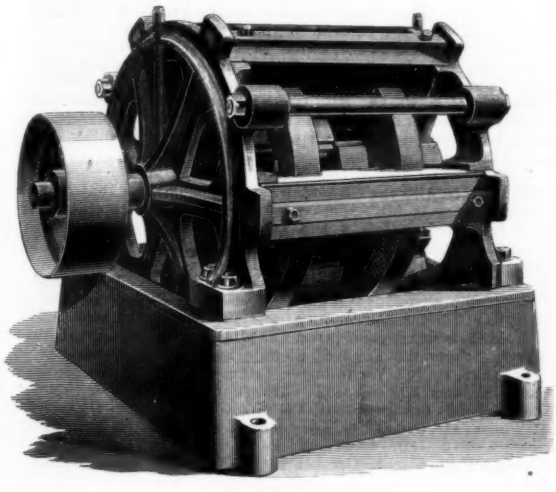


FIG. 1.

There are two pairs of coils in the machine and two sets of inductors, placed as shown in fig. 2, one between the other; one pair of coils and one set of inductors would not do at all, as then the induction would be quite as great in the exciting coil as it would be in the generating coil, as

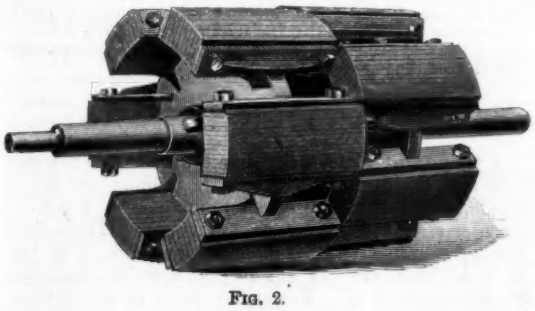


FIG. 2.

they are both wound concentrically. First, the generating coil is wound up and insulated, then the exciting coil is wound over or alongside that, and the whole insulated and fixed in the machine in the recesses formed in the field blocks, see fig. 4, by using two pairs of coils and two sets of inductors, and exciting the coils so that the field blocks are magnetised with a pole in the middle and similar poles at each end, as marked in fig. 4, where the two exciting coils are in "series" with each other, then, any inductive effects on the one exciting coil are exactly and entirely neutralised by those effects on the other exciting coil.

The two generating coils can be coupled either in series or in parallel, but the exciting coils must, for the above reasons, be always in series.

This machine is claimed to be the cheapest and simplest alternator yet brought out; there is no difficulty with insulation, nor in constructing them for any pressure required, practically, and with any frequency.

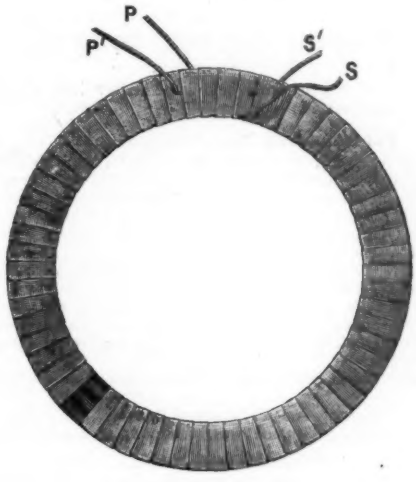


FIG. 3.

In large dynamos there are four pairs of coils and four sets of inductors.

In the machine illustrated, the inductors are 21 inches across diameter, the coils being 21¼ inches inside diameter; the efficiency of the generating coil is equal to 1·35 volts per foot, working at very moderate magnetic flow on closed magnetic circuit and at moderate speed, and this efficiency can safely be raised to 2 volts per foot of generating wire in the coils.

For low pressure alternating currents this machine is equally applicable, and has the advantage of not requiring

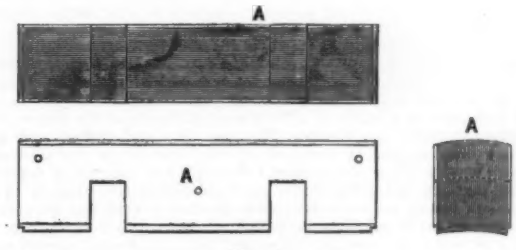


FIG. 4.

laminated copper for the coils however heavy the currents may be.

At central generating stations for electric lighting supply in districts where the station is surrounded by customers, it is a very good plan to use low pressure dynamos, to supply the immediately surrounding neighbourhood direct from the dynamos, and to supply distant customers through step-up transformers.

As a motor, this machine works well, but has to be brought up to synchronism like all other reversed alternators.

A machine with inductors 6 feet in diameter gives an output of 150,000 watts at a speed of little over 200 per minute. 100 volts 1,500 amperes; this is suitable for low pressure distribution round about the dynamo and high pressure to a distance with step-up transformers.

In fig. 3, P^1 P are the terminals of the exciting coil, S^1 S, are the terminals of the generating coils. By using only two

coils in large slow-speed machines, it is expected that the complications hitherto met with in large machines are obviated, most of them requiring two generating coils for each ∿ per revolution. An ordinary machine making one revolution per second would require 200 coils to give ∿ = 100 per second.

A further advantage claimed is that the machine is easily constructed, of good mechanical design, the revolving part, fig. 2, being of simple strong design. The machines are specially designed for the long continuous runs at central generating stations.

LONDON COUNTY COUNCIL.

AT the usual weekly meeting held on Tuesday last, the following reports were submitted:—

REPORT OF THE PARLIAMENTARY COMMITTEE.

We have received from the agent a report on the legislation of the past session with respect to the Bills promoted or opposed by the council, or affecting the County of London, and we submit the substance of it for the information of the council:—

London Overhead Wires, London Sky Signs.—These Bills received the Royal assent on July 3rd.

The following is the result of the Bills which, affecting the interests of London, received our consideration:—Central London Railway.—On the petition of the council, clauses and amendments considered satisfactory for the protection of the interests of the metropolis were duly introduced. The Bill received the Royal assent on August 5th.

City and South London Railway.—Rejected by the Select Committee.

South Kensington and Paddington Subway.—This Bill, against which the council petitioned, was withdrawn on March 16th.

Provisional Orders.

Electric Lighting Orders Confirmation (No. 9).—This Bill, including the following provisional orders, received the Royal assent on July 3rd:—Camberwell, Islington, North Westminster, Southwark, Wandsworth District.

Electric Lighting Orders Confirmation (No. 10).—This Bill, including the following provisional orders, received the Royal assent on August 5th:—City of London, St. Luke, Chelsea, St. Luke, Middlesex, Woolwich.

Electric Lighting Provisional Orders.—The following provisional orders were not proceeded with by the Board of Trade:—East London, Hampstead, Paddington.

REPORT OF THE HIGHWAYS COMMITTEE.

Electric Testing Station.—Meter Inspector.

We reported on October 6th last that Mr. W. Arnot had resigned his office of Inspector under the Electric Lighting Acts and Orders, and that we proposed to advise later on as to the filling of the vacancy. In response to an advertisement issued by our direction, 57 applications were received, and these have been carefully considered by us. Having had before us eight of the candidates who appeared, from their respective applications and testimonials, to be eligible, we have selected one whom we consider the most suitable for the appointment, and we recommend that Mr. Arthur Edward Rossiter be appointed in the engineer's department, on probation for 12 months, the appointment to be subject to confirmation at the end of that time, at a salary of £200 a year, to discharge the duties of an inspector under the Electric Lighting Acts and Orders, and such other duties as may be required of him; that he be not allowed to carry on any other business or to occupy any other paid position; and that his appointment do continue during the pleasure of the council, and be subject to the condition that he shall not be entitled on retirement to any superannuation or pension, and shall submit to any general scheme which the council may adopt with respect to insurance for pensions or superannuation.

Subways.—By-Laws and Regulations.

The council on June 9th last upon our recommendation instructed the Parliamentary Committee to prepare a Bill giving the council power to require companies and others to lay their pipes, &c., in the existing subways, and to pay the council a rent for such user. The Subways Act of 1868 gives the council power to make by-laws relative to the use of certain of the subways, and providing for penalties for breach of such by-laws; and we think that the council should have the same power with regard to all the subways vested in it. We accordingly recommend that clauses be inserted in the Bill about to be submitted to Parliament relative to the subways, to give the council power to make by-laws and regulations with reference to the use of all its subways, existing or hereafter to be constructed, and imposing penalties for the breach of such by-laws and regulations; and that the Parliamentary Committee be instructed accordingly.

Notices under Electric Lighting Acts and Orders.

We have considered a notice, dated October 15th, 1891, from the London Electric Supply Corporation, of intention to lay distributing mains, consisting of concentric lead-covered cables in iron pipes, in Glasshouse Street. There is nothing unusual in what is proposed, and we recommend that the sanction of the council be given to the works referred to in the notice dated October 15th, 1891, of the London Electric Supply Corporation, upon condition that the company do, before commencing the work under this notice, submit for the aproval of the committee the drawings of any boxes which it may desire to construct; and do give two days' notice to the council's chief engineer before commencing any of the works; that the mains be laid under the footways, and be kept 9 inches below the under side of the paving, wherever it is found practicable to do so; that where the mains cross the carriageways they be kept at the same depth below the concrete or the road material, as the case may be; that all pipes or openings from or into the boxes shall be of such shape as to remove all risk of injury to the covering of the cables; that all cables crossing the boxes shall be supported from below in the boxes; that all service lines or small cables shall be protected, where leaving the boxes, by an extra lead covering, or by wooden stoppers, and shall also have a copper wire of sufficient size carried from the service to the main cable, in good connection with the lead or iron outer casing; and that the ends of all mains terminating elsewhere than in a box shall be securely protected by iron caps, in addition to any other covering.

Two notices, dated October 15th and 21st, 1891, respectively, have been given by the Notting Hill Electric Lighting Company of intention to lay mains (1) crossing Westbourne Grove, and (2) in Palace Gardens Terrace and Brunswick Square. The proposed works are of the ordinary character, and we recommend that the sanction of the council be given to the works referred to in the two notices dated October 15th and 21st, 1891, respectively, of the Notting Hill Electric Lighting Company, upon condition that the company do give two days' notice to the council's chief engineer before commencing the work; that the cover stones of the culverts under 20 inches wide shall be not less than 2 inches thick, and of the wider culverts not less than 2½ inches; and that, where the culvert crosses the carriageway there shall be at least 9 inches thickness of Portland cement concrete above the cover-stones of the culvert in addition to the road material.

The Westminster Electric Supply Corporation has given notice, dated October 17th, 1891, of intention to lay mains in Castle Lane, Westminster. There is no objection to the proposed works, and we recommend that the consent of the council be given to the works referred to in the notice, dated October 17th, 1891, of the Westminster Electric Supply Corporation, upon condition that the company do give two days' notice to the council's chief engineer before commencing the works; that the mains be laid under the footways wherever it is found practicable to do so; and that the covers of the street boxes to be used shall consist of iron frames filled in with material to suit the paving.

We have also to report the receipt of the following notices given in accordance with the resolution of the council to accept four days' (instead of one month's) notice in respect of the laying of service lines from mains already laid from the St. James and Pall Mall Electric Lighting Company—October 16th, 1891, to 57, Pall Mall; October 17th, 1891, to 23, Piccadilly; October 20th, 1891, to 172, Regent Street; Mr. T. Hodgkinson's, Pall Mall Place; and the Stereoscopic Company's premises, Glasshouse Street; October 21st, 1891, to 210 and 211, Piccadilly; and 18 and 19, Pall Mall; October 27th, 1891, to 99, Regent Street; October 29th, 1891, to 151, Regent Street. From the London Electric Supply Corporation—October 16th, 1891, to 152, Westminster Bridge Road; to 131, Newington Causeway, and 120 and 132, Borough High Street; to the Surrey Theatre; October 26th, 1891, to the council's offices, Union Road; 21, Parliament Street; 4, Dover Street; and the Alhambra Theatre; October 28th, 1891, to 22, Old Bond Street, and King's Head Inn, Borough High Street; October 29th, 1891, to 14 and 15, Cockspur Street.

Telephonic Communication.

The council, on April 14th last, decided upon our recommendation to accept an offer of the National Telephone Company to place the council's pumping and outfall stations in telephonic communication with the chief office in Spring Gardens for the sum of £204 3d. per annum on a seven years' agreement. We find that upon a report from the Offices Committee the council has recently arranged with the same company for telephonic communication with other premises for a period of three years, and we are of opinion, upon further consideration, that it would be better to limit the period of the agreement in respect of the pumping and outfall stations to that time. We therefore recommend that the agreement be entered into for three years instead of seven, and that the solicitor be instructed to arrange with the company accordingly.

A New Double-Deck Electric Tramcar.—A new double-deck tramcar, designed by Mr. C. L. Pullman and Mr. E. G. Sessions, was recently tried at Pullman, Ill., U.S.A. The car is driven by two Westinghouse motors of 25 H.P. each. The car is 32 feet long, 7 feet 4 inches wide, and 14 feet 9½ inches high, and can seat 40 passengers on each deck, or 80 passengers in all. Passengers enter at the centre and ascend to the upper portion by a spiral staircase. The lower portion consists of two compartments with semi-circular ends, around which the seats are carried in place of the usual end platforms. The car is fitted with electric bells, electric lights, and an electric heater, and also an electric indicator to show the number of seats unoccupied outside. The total weight of the tramcar is about 12½ tons.

NOTES.

The Willson Aluminium Dynamo.—A short time ago (see July 17th, 1891), we illustrated the aluminium dynamo of Mr. Thos. L. Willson, of Brooklyn, U.S.A. We now learn that a company has been formed with the title, The Willson Aluminium Company, to manufacture aluminium according to Mr. Willson's patents.

Obituary.—The death is announced of L'Abbé Caselli, a name best known in telegraphic circles as the inventor of a copying telegraph, an apparatus which, under the name of the "pantelegraphe," was for a few years in use between Paris and Marseilles, but which shared the fate of all such instruments, being of no real practical utility.

Private Electric Lighting at Chelmsford.—Mr. T. H. P. Dennis has completed arrangements with Messrs. Crompton & Co., by which he can undertake any work in connection with electric lighting. He is now lighting his own house and business premises with electricity. In order to encourage the use of electricity as an illuminant, Messrs. Crompton & Co. have arranged an exceptional reduction in its cost.

Dufftown and Electric Lighting.—At a meeting of the Dufftown Police Commissioners, held last week, the report from Messrs. Mavor and Coulson, electrical engineers, Glasgow, in connection with the lighting of the town, was submitted, but discussion and consideration were deferred until the report from Mr. F. Nell, of London, was received. The report to hand estimates the cost of introducing 600 16-candle-power lamps as £2,400.

Tender Wanted.—The Department of Public Works are inviting tenders for the electric lighting of the Abdin Palace at Cairo. The work will include the supply and erection of the engines and all the necessary dynamos and other apparatus for the installation, except brackets, chandeliers, &c. The installation will comprise about 3,000 incandescent and 25 arc lamps. Tenders will be received up to December 1st by the Minister of Public Works, Cairo.

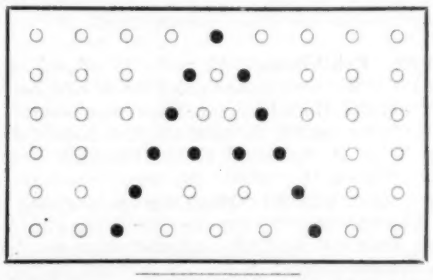
Inverness and the Electric Light. — Mr. James Fraser, C.E., and Mr. Lowe (representing Mr. Frederic Nell, the hydraulic engineer of London), are the engineers appointed to make a report on this scheme. At present the commissioners have, owing to the growth of the town and the rapidly-increasing consumption of gas, been called upon to expend about £10,000 on new plant and machinery; and it is estimated that all the streets and public buildings in Inverness can be lit up with electricity for about half that sum.

Electric Arc Lamps.—What is called a new form of electric arc lamp has been invented by Mr. Xavier Wertz, of New York, in which the two carbons, instead of being opposite to one another, are so constructed that one lies within the other. The larger carbon is hollow, and the other is enclosed within it, but insulated from it by a concentric layer of asbestos. A glass globe, exhausted of air, encloses the carbons. Those of our readers who remember the early days of electric lighting will fail to note any novelty in this arrangement.

Electrical Engineering Pupils.—A most important action came before the Courts yesterday in the case of Mrs. Uniacke, who claimed against Mr. Ronald A. Scott the repayment of a premium of £150 paid by her on the apprenticeship of her son to the defendant, and damages for breach of deed. Mr. Justice Romer gave judgment for the plaintiff, and assessed the damages at £120, the defendant to pay the costs of the action, the counter claim against the plaintiff being dismissed. His Lordship, in giving judgment, made some severe remarks upon the conduct of Mr. Scott's business. He said that apparently Mr. Scott only employed seven or eight workmen, and about 65 apprentices. He (the judge) was quite convinced that the son was not taught, or attempted to be taught to any substantial degree, the art of electrical engineering. He was only doing work which saved the whole or part of a workman's wages. In his opinion the defendant had done what amounted to grave breaches, entitling the plaintiff to sue for damages.

The Recent Fatal Accident at Lauffen.—Concerning the accidental death of Mr. Rau at Lauffen, Dr. Heim, who was an eye witness, informs the *Elektrotechnische Zeitschrift* that at the time the tests of the commission were being made, Dr. Heim had charge of the Cardew voltmeter, and noticed a sudden fall of from 10 to 20 per cent. in the potential difference, just at the time when Rau came in contact with one of the overhead high tension wires in another part of the premises. The telephone bell began to ring simultaneously with the change of potential, although it was not connected with any of the wires. This ringing alarmed one of the engineers in charge of the switchboard, who ordered the turbine to be stopped, and rushed into the transformer room, where he found Rau lying insensible on the floor, face downwards, and his body bent as if in convulsions. When lifted upon a chair, the chest and arms of the unfortunate man gave several jerks; but 40 seconds after this there were no signs of motion, the face was perfectly pale, the eyes closed, and the limbs quite limp. Cooling the head and chest with water and various modes of revival were tried without success; the heart had already ceased beating. On the palm of the right hand, near the little finger, was a charred wound, about three-eighths of an inch deep, whilst a large portion of the back of the hand was singed. The left hand and fingers were much burnt on the outside, as if the hand had been held to a large flame. It appears that Rau went, without permission, into the transformer house, and attempted to attach some leads intended for an incandescent lamp in the office. He carelessly climbed up some 6 feet within reach of the bare high tension wires, and there met his death. Near the place where his hand touched, the woodwork was charred.

Electric Signalling in the Navy.—A new method of nautical signalling was shown at the Naval Exhibition by Mr. C. K. Kelway, consisting of a number of lamps placed in a suitable frame and worked from a keyboard or compound switch. A key is appropriated for each letter of the alphabet and for numerals. On this key being depressed, the electric current is switched on to the lamps representing the corresponding letter. On the pressure being removed, the lights disappear, and the next letter, or numeral, is in like manner shown. It is claimed that the words can be spelt out at a rate more quickly than by the Morse system. This application of electricity to naval needs will commend itself to those who know that while smart senders are abundant, really good receivers of signals are not nearly so numerous, either in the army or the navy. In the invention referred to, the receiver simply has to stand on the deck of a ship and read the letters of the alphabet in letters 6 feet high as they are signalled. It certainly possesses considerable advantages over the present system of signalling at sea at night by hand lamps. The diagram shows the letter A made up of lighted lamps, the small dots indicating those not in circuit.



The Discoverer of Insulation.—Mr. T. D. Lockwood, in an article contributed to the *Electrical World* of a recent date gives some interesting extracts from various sources relating to this subject. The earliest reference he mentions is that contained in the celebrated letter of "C. M." (Charles Marshall) to the *Scots' Magazine*, suggesting an electric telegraph. This was published in 1753, and contains the following statement:—"Lay over the wires from one end to the other with a thin coat of jeweller's cement." As in the case of the "invention of the steam engine," no definite period can be named from which dates the discovery; the whole idea "growed." Probably the earliest *existing* system of insulation is that used by Sir Francis Ronalds, specimens of which are extant.

Electric Lighting of Lighthouses.—It is said that the Mumbles Lighthouse, one of the most important, is to be fitted up with the electric light.

The Institution of Electrical Engineers.—On Thursday November 12th, 1891, the following paper is announced to be read:—"Description of the Standard Volt and Ampère Meter used at the Ferry Works, Thames Ditton," by Captain H. R. Sankey (late R.E.), Member, and F. V. Andersen, Associate.

Action to Recover Commission.—In the Queen's Bench Division on Wednesday, the case of Muirhead *v.* the Debenture Guarantee Investment Company, Limited, came before Mr. Justice Denman and a special jury. It was an action to recover commission for the introduction to the defendants of the St. James's Electric Light Company, who required capital which was supplied by the defendants. Mr. Finlay, Q.C., was counsel for the plaintiff, and Mr. Jelf for the defendants. After the action had made some progress a settlement was arrived at, and judgment was entered for the plaintiff for £1,200, without costs.

Electric Lighting at Brighton.—At the Council meeting last week exception was taken to the laying down of an electric light main in Middle Street. It was contended that the Council should have an alternative system, so that they could supply the light to all who wished. Overhead wires should be adopted, otherwise the capital expenditure on their mains would swamp them. The committee stated that they were going to work cautiously, and unless they could see a fair return for their expenditure they would hold their hands. The popularity of the light was increasing, and any desire on the part of the committee to mislead any member of the Council was strongly disclaimed. The decision of the committee to lay the new main in Middle Street was then confirmed.

Telephonic and Telegraphic Coast Communication.—In a letter to the *Times*, Mr. Edward Birkbeck, the Chairman of the Royal National Lifeboat Institution at Norwich, announces that it is his intention to move a resolution on the above subject in the House of Commons early next session. The terms of his notice are as follows:—"That, with a view to the better prevention of loss of life and property in cases of shipwreck, and to give speedy information to lifeboat authorities and rocket apparatus stations, in the opinion of this House it is desirable that telephonic and telegraphic communication should be provided by Government between all the coastguard stations and signal stations of the coast of the United Kingdom, and, on such parts of the coast where there are no coastguard stations, the postal telegraph offices nearest to the lifeboat stations." Mr. Birkbeck states that it has been estimated that £100,000 would be sufficient to establish such a system, which is a small amount when the vast importance of the object is considered.

Brewers' Exhibition.—At the 13th annual exhibition and market of the brewing and allied trades held last week at the Agricultural Hall, Islington, there were several exhibits of an electrical nature, the most effective display of electric lighting being at the stand of the Campbell Gas Engine Company, where a "Campbell" gas engine was shown driving a dynamo, which supplied current to some handsome pendant lamps. The electrical arrangements and fittings were by Messrs. Cathcart, Peto and Radford. Another stand was lighted by Messrs. Laurence Scott & Co., of Norwich, a "Norwich" dynamo being driven by a gas engine, bearing the following statement: "Twenty electric lamps for twopence an hour." Messrs. Easton & Anderson had a stand at which were shown a combined high speed engine and "Whitehall" dynamo, supplying current for several small motors working exhibits in distant parts of the building. Two of them drove electric Blackman fans, a new form of the well-known ventilator, the invention of Mr. Watel. It is said to be thoroughly efficient, and extremely economical in working, and was largely employed by the committee of the late Electrical Exhibition at Frankfort. Messrs. Dick, Kerr & Co. had an exhibit of their "Griffin" gas engines, showing their efficiency in driving electric and other machinery, and the "Stockport" gas engine was also exhibited, driving a dynamo for lighting purposes.

The Chicago Exhibition.—No less a sum than £300,000 is to be devoted to the electric lighting of this exhibition.

Bournemouth Telephones.—Owing to the recent electric light wire accident, the Bournemouth telephone subscribers have been unable to use the lines for over a week; we now learn that repairs have been made, and the exchange is working satisfactorily.

Electric Boat in Berlin.—Plans have been submitted to the municipal authorities of Berlin of an electric boat for passenger traffic on the River Spree. The project is being favourably considered by the Municipal Council.

Electric Lighting of Mumbles Pier.—The proposed pier at the Mumbles is to be entirely lighted with electricity. The total length of the structure will be about half-a-mile. The Mumbles Railway and Pier Company, Limited, are the promoters of the scheme, the capital being £80,000.

Thomson-Houston Factory at Lynn, Mass.—So large a part does the great Thomson-Houston factory at Lynn, Mass., play in the affairs of that city that the *Lynn Daily Press* maintains a regular department of news items gathered at the factory headed "At the Electric Works." This appears daily.

American Society of Mechanical Engineers.—The annual meeting of this society is to be held in New York City. Business will be commenced on the 16th inst., by an address from the president, and will close on 20th inst., on which day a number of papers will be read, including one by Mr. H. C. Spaulding, on "Electric Power Distribution."

Personal.—Mr. Arthur C. F. Webb, son of Mr. F. H. Webb, the secretary of the Institution of Electrical Engineers, has been gazetted as second lieutenant in the New South Wales P.P. Submarine *Miners*. Mr. Webb is now instructor in electricity and telegraphy to the Electric Telegraph Department.

Telephone Patents in Litigation.—Telephonic litigation is by no means at an end, and the news comes from America that the American Bell Telephone Company has brought a suit against the Metropolitan Telephone and Telegraph Company of New York, in the United States Circuit Court, to prevent the use or sale of telephones embodying the Bell patents.

The Electric Light to be used at Guildford.—A meeting of influential inhabitants met together last week to consider the introduction of the electric light into the town. It was resolved to form a sort of mutual association for the supply of electricity to members only. As the law at present stands, we are afraid the association will have some difficulty in obtaining a licence.

Presentation.—Last week Mr. T. A. F. Cutler, on behalf of the whole staff of the Bath Electrical Engineering Company's Central Lighting Station, presented Mr. B. Deakin with a handsome writing and stationery cabinet, also an amber and silver mounted briar pipe in case. Mr. Deakin is now undertaking the charge of the extensive lighting station which the Brush Electrical Engineering Company are at present equipping for the City of London Electric Supply Company.

Swansea Telephones.—Mr. John S. Brown, the well known Swansea electrical engineer, has just completed an important contract with the Swansea Corporation, who accepted his tender for erecting 22 miles of telephone lines in the town. They have also arranged with him to maintain the corporation telephones for seven years. Mr. Brown by the way, has just completed his 50th electric light installation in surrounding works and collieries.

The Telephoning of Great Cities.—After our correspondence columns were made up we received two letters on this subject from Messrs. Miller and Mann, respectively. They will occupy between six and eight columns, and must remain over till our next issue. We would once again urge upon correspondents the necessity of sending in communications by Wednesday morning to ensure insertion in the current number of REVIEW.

The Electric Light in Canada.—The Laval University at Quebec, Canada, has just been installed with the electric light. No less than 1,500 incandescent lamps are arranged over the building.

Market Lighting.—The Swansea Town Council have decided to spend £20,000 in rebuilding and improving the market in Oxford Street, which it has been proposed to light with electricity.

Printing by Electricity.—Our American contemporary, the *Western Electrician*, announces that the presses on which that journal is printed are soon to be operated by electricity. A 25 horse-power Edison motor has been installed, and it is expected that this motor will furnish enough power to operate a large number of the presses.

American Railway Carriages for the South Eastern Railway.—The South Eastern Railway Company have recently received from the Gilbert Car Manufacturing Company of Troy, N.Y., U.S.A., a complete train, consisting of four drawing room cars, one buffet car and one luggage van, built on the American principle. The whole of the cars are to be illuminated by the electric light by means of secondary batteries to be charged by the existing plant of the South Eastern Railway Company.

Electric Light at Exeter.—The Exeter Electric Lighting Company has applied for powers to raise £10,000 first mortgage debentures for the purpose of carrying their wires underground, so as to do away with the unsightly posts, and for extending their operations to meet increasing demands.

Twenty-Seven Thousand Volts. — Mr. Lindley, the President of the Test Committee of the late Frankfort Electrical Exhibition, informed the General Electricity Company on Saturday that the Lauffen-Frankfort plant has been successfully transmitting current at 27,000 volts.

Electric Light Accident at Chelmsford.—Messrs. Crompton, referring to the recent accident at Chelmsford, write us as follows :—The accident which recently occurred at Chelmsford, and which has been somewhat widely reported, is interesting in one respect, that it shows that the use of overhead wires may in some cases increase the safety of the public instead of being dangerous, as has been so often stated by their opponents. A runaway omnibus passing through the narrow street which leads to the station came in contact with one of our arc lamp posts with such violence as to break off an exceedingly massive casting at the ground line. If the wires had been underground the pole would have fallen into the street, and probably caused serious damage. As it was, although broken short off, it was held upright by the system of overhead conductors attached to it, and no damage was done to anything but the arc lamp itself.

O.S.A. Dinner.—The annual dinner of the Old Students' Association of the City and Guilds of London Institute took place on Saturday last at the Holborn Restaurant. Mr. W. B. Esson, as President, occupied the chair, and he was supported by the vice-presidents for the past year, Messrs. Albion T. Snell and A. Reckenzaun. There was a good attendance, and the usual toasts were given and received with enthusiasm. Dr. Silvanus Thompson, whilst responding to the toast of "The Colleges of the City and Guilds of London Institute," reviewed the growth and the work of the Finsbury Technical College during the past six years. He declared that the students who pass the college have often great difficulties in obtaining employment, and he urged old students who are now occupying responsible positions to interest themselves in the welfare of the younger members of the electrical profession. He was glad to notice that there is scarcely a central station or electrical works of magnitude where old students of the Finsbury or the South Kensington Colleges are not to be found. But they were turning out numbers every year, among whom there were worthy fellows who did not fall into employments suited to their training. Mr. Reginald Jones, the honorary secretary, promised to work out a scheme of his own which would comprise an employment register, together with a description of the special qualifications of each candidate. We commend this worthy effort to the attention of the whole electrical trade.

New Electric Railway.—The Brecon Town Council have decided to take immediate steps for the formation of an electric railway to the Beacons. There would be three stations besides the terminus.

The Electric Light in South London.—The large clothing establishment of Messrs. Dunn in Newington Causeway, S.E., has recently been fitted throughout with the electric light by Messrs. H. F. Joel & Co., of 31, Wilson Street, Finsbury. The exterior of the building is also illuminated by means of 10 large incandescent lamps, six mounted on posts and four suspended by means of brackets.

International Telephonic Communication. — The London-Paris telephone, no doubt, completed a work worthy of emulation, and, following the good example, the first telephonic connection between Austria and Germany, on the line from Reichenberg and Zittau, has been opened, and it is said that the directors of the Belgian and Netherlands telephones are also considering a scheme for connecting the systems of the two countries.

A Satisfactory Dividend.—On Saturday the Accumulator Works Co., Limited (Müller and Einbeck), held their annual meeting in Hagen, when a dividend of 15 per cent. for the past eighteen months was declared, or at the rate of 10 per cent. per annum. The orders received during this year to date amount to £80,000.

Improper Navigation of an Electric Launch.—At the Staines Petty Sessions, recently, Edward W. Bonson was summoned at the instance of the Thames Conservancy for having navigated the electric launch, *Kappa*, on the river at Laleham, on September 23rd, in such a manner as to endanger the lives of persons and the safety of other vessels. Mr. Thomas Weeding, a justice of the peace for Chertsey division, said the defendant ran into his yacht on the day in question. Defendant was given a good character as a capable navigator by the manager of the Electric Launch Company. The Bench fined the defendant £3, including costs. The General Electric Power and Traction Company, defendant's employers, wrote to Mr. Weeding offering to make good all damage done.

Electric Lighting Worcester Cathedral.—On the occasion of Lord and Lady Dudley's return to Worcester, last Saturday, the townspeople gave them a brilliant reception, and in the evening much interest was excited amongst the inhabitants by a special electric light display at the Cathedral, which was undertaken by the British Electric Installation contractors, under the superintendence of their consulting engineer, Mr. Morgan Williams. The plant was a portion of that which has lately been doing duty at the Naval Exhibition, and was brought down and erected by the staff of Mr. Ronald A. Scott, Acton, who exhibited it there. The pinnacles of the tower, which are 420 feet high, were lighted up by four arc lamps, and on a platform on the roof a 30,000 candle-power search light was placed. In another portion of the town the same company carried out under the direction of Mr. Oswald Swete, their acting engineer, the lighting of a leading tradesman's shop by a storage battery sent down from London.

The Institution of Electrical Engineers' Annual Dinner.—Amongst the guests who have accepted invitations to be present at the annual dinner on November 13th are the following :—The Postmaster-General (Sir J. Ferguson, Bart., G.C.S.I., M.P.) ; the Inspector-General of Fortifications (Major-General Grant, C.B., R.E.) ; Sir G. G. Stokes, Bart., M.P. (late President of the Royal Society) ; Sir John Pender, K.C.M.G. ; Sir Thomas Blomefield, Bart. (Board of Trade) ; Captain W. J. L. Wharton, R.N., F.R.S. (Hydrographer to the Admiralty) ; Mr. H. J. Chaney (Standards Department, Board of Trade). The Presidents of the following Societies :—The Institution of Civil Engineers ; the Institution of Mechanical Engineers ; the Iron and Steel Institute ; Mr. Harrison Hayter (V.P. of Inst. of C.E.) ; Mr. Alfred Giles, M.P. (V.P. of Inst. of C.E.) : Sir Benjamin Baker, K.C.M.G. (V.P. of Inst. of C.E) ; Dr. William Pole, F.R.S.S. (L. and E.), (Hon. Secretary Inst. of C.E.) ; Col. W. Haywood (Engineer to the Commissioners of Sewers).

Electric Lighting at Southampton.—The whole of the new factory premises recently erected by M. Auguste Pellerin are effectively illuminated by electricity.

Electric Light Companies' Shares. — Metropolitan Electric Supply, St. James's and Pall Mall, and Westminster Electric Supply shares, all seem to be rising in value.

Lighting the City of Mexico.—The cost of the lighting of the City of Mexico in 1890 amounted to £34,859. At present this lighting consists of 298 Brush arc lights of 2,000 C.P., 135 Brush arc lamps of 1,200 C.P., 408 gas lamps, 461 turpentine lamps, and 1,169 naphtha lamps.

Another Mumbles Hotel to use the Electric Light.—It is stated that the Osborne Hotel, Mumbles, which is now in course of construction, will be lighted throughout with electricity. Considering that the nearest gasworks are six or seven miles distant, such innovation is but right and natural.

Secondary Battery Patents.—The Tommasi accumulator, which we described in our last number, seems clearly to have been anticipated by a patent granted to George Barker (communicated from abroad by Henry Woodward, of Toronto), and dated April 23rd, 1890. The number of the patent is 6,176 of the year mentioned, and, in justice to Dr. Woodward, we place his claim to priority on record.

NEW COMPANY REGISTERED.

Bicester Electricity Supply Company, Limited.—Capital £5,000 in £5 shares. Objects: To carry on at Bicester the business of an electricity supply company in all its branches. The signatories are (with one share each): Fred. Smith, W. Grimsley, J. W. Smith, T. W. Parkhurst, T. C. Fruch, J. Colman, and G. T. Cannon, all of Bicester. Registered on the 2nd inst., without articles of association, by Messrs. Inderman, Clark and Parker, 1, Devonshire Terrace, Portland Place, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Welding Company, Limited.—The offices of the above-named company have been removed from 2, Tokenhouse Buildings, London, E.C., to 6, Great George Street, Westminster, S.W. Filed 26th ult.

Law's Electrical Appliances Company, Limited.—The first registered office of this company is situated at 2, Jackson Road, Holloway. Filed 27th ult.

BUSINESS NOTICES, &c.

Rashleigh Phipps and Dawson.—Messrs. Rashleigh Phipps and Dawson opened, on Monday last, their extensive new manufactory in the Euston Road. This consists of magnificent workshops, with excellent light, affording accommodation for over 300 hands, and is probably the largest and best fitted art metal works in London. The foundry and iron forges are on the ground floor, and a large Robey steam engine is employed to drive the lathes. The new factory is in addition to their works in the rear of their head offices in Berner's Street. Messrs. Rashleigh Phipps and Dawson have had to apologise recently for delay in execution of orders, but they fully expect now to be able to turn out work with unusual facility.

Ernest Scott & Mountain.—This firm is supplying a complete installation of an important character for the Earl of Ellesmere's new mansion and training establishment at Newmarket. There will be about 280 16-candle power lamps, 100 of which will be in the house and the remainder in the stables and other buildings. The dynamo will be a "Tyne," specially wound for running as a compound wound machine when feeding the lamps direct, or as a shunt wound machine when charging accumulators. The engine is of the horizontal type, capable of working up to 30 indicated H.P. Messrs. Ernest Scott and Mountain have changed the London address from 110, Leadenhall Street to 100c, Queen Victoria Street, and their telegraphic address to "Potential," London.

Marshall, Sons & Co.—Messrs. Marshall, Sons & Co., of Gainsborough, have issued a list (No. 132, September, 1891) containing descriptions of their high-class long-stroke horizontal fixed engines fitted with the Proell patent two-valve releasing gear. A single cylinder engine of this type has been working the electric lighting installation at the British Museum for eighteen months. It also gives an illustration and full explanation of the releasing gear and the patent governor used with it, which is very sensitive and can be fitted with a speed-adjusting arrangement, so that the speed of the engine may be varied 10 per cent. whilst the engine is running.

G. E. Belliss & Co.—We understand that Messrs. G. E. Belliss & Co., of Birmingham, have had very satisfactory results from exhibiting at the Naval Exhibition; and the rapid increase to their London business in this and other ways, has necessitated opening a London office. This will be opened on the 9th at Westminster Chambers, 9, Victoria Street, and will be under the management of the present London representative of the firm, Mr. Crawford.

Fowler-Waring Cables Company.—The company has issued a price list, giving not only particulars and prices of the covered wires and cables manufactured by the company, but also explaining the process of sheathing both what are called lead-covered and lead-foiled. Directions are given for jointing and insulating electric light cables and single wires, and for stringing aerial cables, illustrated by numerous woodcuts.

Moon and Wall.—Mr. J. G. Moon and Mr. C. Wall have commenced business in partnership at the Globe Engineering Works, Brentford. Mr. Moon was lately manager of the Electrical Engineering Corporation's works at West Drayton, previous to which he was with Messrs. J. H. Holmes & Co., of Newcastle. Mr. Wall also gained his experience in the same establishments.

Laurence, Scott & Co.—A large number of shiplighters have been sent from the Gothic Works, Norwich, during the last 18 months to Scotland and the north of England. This sounds a little like sending "coals to Newcastle," and shows that the firm is well sustaining its reputation for reliable work in this line.

Tender Accepted.—At a Meeting of the Halifax Town Council, on Thursday, 29th inst., it was decided that the tender of Mr. F. E. Stuart, Twickenham, for fixing an electrical call bell system in connection with the new fire brigade station, for £40 10s., be accepted.

Messrs. Wheatley Kirk, Price and Goulty.—These gentlemen will conduct an important sale of electrical apparatus at 39, Queen Street, E.C., on Wednesday next, 11th, particulars of which will be found in an advertisement.

G. G. Blackwell.—Mr. Blackwell has issued a circular announcing that he has secured the entire production of the "Fine Silvery" French chalk as previously supplied by Messrs. G. Huntriss and Co., of Liverpool.

John Pound & Co.—This well-known firm of cutlers and travelling case makers have recently added an electrical department to their business in Leadenhall Street.

CITY NOTES.

The Montevideo Telephone Company, Limited.

THE annual ordinary general meeting of this company was held at the offices, 25, Abchurch Lane, E.C., on Friday last, Mr. Arthur Holland presiding.

The SECRETARY read the notice convening the meeting, and the CHAIRMAN in moving the adoption of the report stated that, as compared with the previous year, the profits for the year under consideration had diminished by £5,381. This diminution was due to the subscriptions having fallen off, also to the London expenses having risen, to the writing off of bad debts, and to the defalcation by the company's collector at Montevideo. It was a matter which had caused the directors considerable regret to have to present a report with this large diminution of profit, but the chairman thought that when the shareholders heard the explanation which they had to give, they would be satisfied that the directors could not have done more to obviate the difficulties than they had done. The increase of £75 in the London expenses had arisen from the fact that they had debited them with interest on money which they borrowed last year to pay the dividend. They had not funds to pay that dividend, and therefore they borrowed it at a small expense. The other items in the London expenditure had been reduced all along the line by small amounts. As regarded the expenses at Montevideo, which had gone up by £1,051, the chairman found on looking into them, that wages had been reduced by £61, and from steps they had taken in the course of the past year they will be considerably less in the current year. Rent had increased by £170 and that was owing to the failure of the tenant they had in part of the buildings of the company, as he had left and they had been unable to get a fresh tenant. Cost of materials had gone up £766, which was a large amount; but they had been put to considerable expense by reason of the Municipality of Montevideo compelling them to remove the posts from certain of the streets and they had had to spend a considerable sum of money in laying fresh wires and cables. The bad debts was a very serious amount for which they had written off in the two first years £660 and

£852 respectively. They had lost by the defalcations of their collector in Montevideo £332, so that on the whole, as compared with last year, their accounts showed a diminution of £5,381. This was a matter which caused the directors considerable regret, but arose from causes over which they had no control. Having explained the reason of the increase in the expenses here and in Montevideo, he stated that steps had been taken to effect a reduction in this respect in the future. There had been almost a collapse of commerce in the River Plate, and considering the depression and difficulties consequent thereon, the directors thought it was a matter of congratulation that the position of the company was not worse than it was. Including the balance of £184 brought forward from last year, the accounts showed a profit of £4,970. As to the defalcations of their collector, they would endeavour to find some more certain method of check than they had hitherto had. This collector was guaranteed by a guarantee society in Montevideo to the extent of $1,000, but unfortunately, in consequence of the badness of the times, that society had gone into liquidation, and they could not look to get anything. The badness of trade had led to a considerable falling off in the number of their subscribers, and they had also, in consequence of these bad times, had to face this exceptional amount of bad debts. Of course, the future of the company depended largely on what was done by Uruguay, but the directors could not but think that the company had reached bed rock as regarded the minimum subscribers. The reports from the pastoral and agricultural districts were favourable to a good season, and this might be expected to react upon the towns, and then they might look for an increase in the number of their subscribers. Another thing which would materially affect the number of subscribers was the contemplated reduction in the taxation of the country, by reason of the new arrangement the Uruguayan Government was making with its bondholders on this side. If the inhabitants were going to be relieved of a certain amount of their taxation they would probably put more money into business, which would have a beneficial effect upon the company. They had had no less than 500 odd subscribers cease, of whom 372 had given their reason as economy; 69 had failed, 47 had left Montevideo, 17 had gone over to their competitors, and two had assigned no reason. On the other hand, it was satisfactory to note that they had had an accession of new subscribers to the extent of 315, notwithstanding the bad times. He hoped when next they met they would have a more satisfactory statement to lay before the shareholders. The failure of the National Bank of Montevideo also affected them, but they hoped for better things in the current year.

The motion was seconded by Mr. T. D. PETERS, and some questions raised by Messrs. Balfour, Henderson and Sandford having been answered by Mr. E. F. Powers (managing director), it was put and agreed to.

The retiring director (the chairman) was re-elected, as were also the auditors (Messrs. Gerard Van de Linde and Son).

A vote of thanks to the chairman closed the proceedings.

Crompton and Company, Limited.

AN extraordinary general meeting of this company was held at the registered offices of the company on Tuesday last, as already announced in our columns, Mr. R. E. B. Crompton presiding.

The SECRETARY (Mr. F. R. Reeves) read the notice convening the meeting, and

The CHAIRMAN said that the purpose for which the shareholders had been called together was an exceedingly simple one; it was to explain to them the reasons why it was proposed to increase the capital of the company. He need hardly call to their recollection that the company, until three years ago, was a private partnership, which had a small beginning, and gradually got to hold a considerable position. The growth of the company had been continuous, and perhaps even more rapid now than when it was a private partnership. The turnover had advanced by leaps and bounds, that is, each year it had increased 30, 40, and 50 per cent., and at the present time it stood at a figure two and a-half times what it was at first. Their calculations at the time it was started were not that the business would grow so largely, and in consequence they had already found themselves considerably crippled, and had had to refuse some very valuable orders which had been offered to them, simply because they had not sufficient capital to carry them out. They had refused such orders as required heavy expenditure, and for which they could not expect to be paid very quickly. Considering that the capital the shareholders had already invested had been invested in such a satisfactory manner, and considering that not only the preference interest had been so easily earned, but there had been a large margin over to pay to share dividend, it was evident that they should have the capital raised. They had to consider the various means of doing this, and the directors had come to the decision that the best way to do it was to pass the resolution given in the notice which had been distributed. To give them some further idea as to how far want of capital crippled their business, he stated that when they had plenty of capital they could pay absolute cash for all their materials which they purchased, and when they were really compelled to pay them in three months they lost considerable discounts, and the gain that they would get in obtaining the capital would be very great in that one respect. The persons mostly affected by that increase of capital were the ordinary shareholders, which were very few. In fact he (the Chairman) and Mr. Albright were the principal ordinary shareholders. Having such a large interest at stake, they could not possibly think of sanctioning such an increase without carefully weighing the cost, and they came to the conclusion that they were justified in sanctioning it, and they thought they would also participate in the benefits. It had been suggested to the board that the new shares should be issued at a premium, but after thinking it over, they had decided to issue 5,000 of the new shares to the existing shareholders at par. Their preference shares were at a considerable premium, and they thought it fair that the existing shareholders should have the benefit of these 5,000 without a premium. The remainder the directors would consider whether they should be issued at a premium or not. They had obtained the opinion of the shareholders by issuing proxies, and they had proxies to a very enormous extent—to more than three-quarters of the amount. The chairman then moved:—"That the capital of the company be increased by the issue of 10,000 additional shares of £5 each, such shares to be numbered 20,001 to 30,000, inclusive, and to rank for preference or priority as regards dividends, and in the distribution of assets, and in all respects *pari passu* with the already existing preference shares of the company, and the directors are hereby authorised to issue these new shares at such times and on such terms as they may think fit."

This was seconded by Mr. ALBRIGHT, and carried without any dissentients.

The proceedings then terminated.

The Western and Brazilian Telegraph Company, Limited.

THE directors' report for the half-year ended June 30th, 1891, states that the total earnings amount to £104,962 9s. 7d as against £89,846 13s. 9d., an increase of £15,115 15s. 10d. compared with the half-year to June 30th, 1890. From the above total earnings has been deducted the sum of £11,121 4s., paid in respect of traffic receipts between March, 1889, and December, 1890, hitherto under dispute.

The working expenses amount to £38,638 10s., as against £40,509 13s. 3d., a decrease of £1,871 3s. 3d.

Including the amount brought forward from 1890 (£6,070 6s. 1d.) and the dividend received upon the shares held in the "Platino" Company to June 30th, the balance to the credit of the revenue account is £79,781 10s. 8d., from which has to be deducted £12,866 10s. for debenture interest, and £6,233 10s. for the debenture redemption fund, leaving £60,681 10s. 8d., of which £25,000 has been placed to the reserve fund. This leaves £35,681 10s. 8d. The directors recommend the payment of a dividend of 6s. per share, free of income tax, on the ordinary shares for the half-year, being at the rate of £4 per cent. per annum, carrying forward £6,470 4s. 8d. At the corresponding period last year the dividend was at the same rate.

The arrangement with the Montevidean and Brazilian Telegraph Company, already approved by the shareholders, was completed on June 11th, and 5,300 ordinary shares were issued in exchange for the undertaking of that company, which has now been wound up.

The new cables between Pernambuco and Bahia, Bahia and Rio de Janeiro, and Rio de Janeiro and Santos have been satisfactorily laid by the contractors, the India Rubber Gutta-percha Telegraph Works Company, Limited. They were duly taken over, and have greatly improved the working of this company's traffic.

The section between Pernambuco and Ceara, which contained the last long length (over 200 miles) of original cable, was interrupted in March, and could not be repaired owing to the type of cable, its condition, and the great depth of water. The probability of this happening has been previously referred to, and although this section has now given way it has lasted a considerable time longer than the directors anticipated. Arrangements were therefore made to send out sufficient new cable in the *Silvertown* to restore communication and this was successfully done in September.

The dividend warrants will be posted on November 13th.

The Electric Trust, Limited.—The Electric Trust, Limited, offers for public subscription 4,000 ordinary shares of £10 each. An installation on the high-tension system has been made at Woking, and one on the low-tension system at Westminster, and the directors consider the present a favourable time for extending the sphere of their operations. They therefore propose to increase the capital of the trust to £60,200, in 6,000 ordinary shares of £10 each and 200 founders' shares of £1 each. Of this amount 2,000 ordinary shares and the 200 founders' shares have been privately subscribed, and the balance of the ordinary shares is offered for public subscription at par.

TRAFFIC RECEIPTS.

The City and South London Railway Company. Traffic receipts for the week ended November 1st, amounted to £802.

The Cuba Submarine Telegraph Company, Limited. The estimated traffic receipts of the Cuba Submarine Telegraph Company, Limited, for the month of October, were £3,200, as compared with £3,310 in the corresponding month of last year.

Direct Spanish Telegraph Company, Limited. The estimated traffic receipts for the month of October, 1891, are £2,486, as against £2,779 in the corresponding period of last year.

The Eastern Extension, Australasia, and China Telegraph Company, Limited.—The traffic receipts for the month of October amounted to £42,246, as against £47,117 in the corresponding period of 1890, showing a decrease of £4,871

The Eastern Telegraph Company, Limited. The traffic receipts for the month of October were £60,784, as against £59,589 for the same period of 1890, an increase of £1,195.

The Great Northern Telegraph Company. Receipts in October, 1891, £24,400; 1st January to 31st October, 1891, £237,800; corresponding months 1890, £232,800; corresponding months 1889, £229,200.

SHARE LIST OF ELECTRICAL COMPANIES.

Present Amount Issued.	Name.	Stock or Share.	Closing Quotation. (Oct. 29th.)	Closing Quotation. (Nov. 5th.)	Business done during week ending (Nov. 5th, 1891.) Highest.	Lowest.
250,000*l*	African Direct Telegraph, Ltd., 4 p. c., Deb. Regd. and to Bearer	100	100 —103	100 —103	...	...
1,300,980*l*	Anglo-American Telegraph, Limited	Stock	48 — 49	49 — 50	49¾	48½
2,849,510*l*	Do. do. 6 p. c. Preferred	Stock	87 — 88	87 — 88	87¾	87
2,849,510*l*	Do. do. Deferred	Stock	12⅜— 13½	12⅜— 13½	13	12⅞
130,000	Brazilian Submarine Telegraph, Limited	10	11¼— 11¾	10⅜— 11¼	11 9/16	10⅜
53,200*l*	Do. do. 5 p. c. Bonds	100	100 —103	100 —103	...	...
75,000*l*	Do. do. 5 p. c., 2nd Series, repayable in June, 1906 ...	100	103 —107	103 —107	...	...
77,978*l*	Brush Electrical Engineering Ordinary, Nos. 1 to 63,416	3	3¼— 3½	3⅜— 3⅝	3 9/16	3¼
69,996*l*	Do. do. Non cum. 6 p. c. Preference, Nos. 1 to 63,416	2	2 — 2¼	2⅛— 2⅜	2⅜	2
50,000	City and South London Railway, Nos. 1 to 50,000	10	2 — 4	3 — 5	3½	...
$7,716,000	Commercial Cable, Capital Stock	$100	140 —142	135 —140	138	137
224,850	Consolidated Telephone Construction and Maintenance, Limited ..	14/-	7/16— 9/16xd	7/16— 9/16xd	½	...
20,000	Crompton & Co., Ltd, 7 p. c. Preference Shares, Nos. 1 to 20,000	Stock	5 — 5½	5 — 5½	...	...
16,000	Cuba Telegraph, Limited	10	10 — 11	10 — 11	10⅝	10½
6,000	Do. do. 10 p. c. Preference	10	17 — 18	17 — 18	...	...
12,931	Direct Spanish Telegraph, Limited, ... (£4 only paid)	5	3½— 4	3½— 3¾	...	...
6,000	Do. do. 10 p. c. Preference	5	9½— 10½	9½— 10½	...	...
60,710	Direct United States Cable, Limited, 1877	20	10⅞— 11⅛	10⅞— 11⅛	11	10⅞
400,000	Eastern Telegraph, Limited, Nos. 1 to 400,000	10	14¼— 14½	14¼— 14½	14⅜	14 5/16
70,000	Do. 6 p. c. Preference	10	15 — 15½	15 — 15½	15¼	15⅛
200,000*l*	Do. 5 p. c. Debs. (1879 issue), repay. August, 1899	100	107 —110	107 —110	108¼	...
1,200,000*l*	Do. 4 p. c. Mortgage Debenture Stock	Stock	106 — 109xd	106 — 109xd	108⅛	106½
250,000	Eastern Extension, Australasia and China Telegraph, Limited ...	10	15⅛— 15⅜	15⅛— 15⅜	15⅜	15
78,300*l*	{ Do. 5 p. c. (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,049, 3,976 to 4,326 }	100	104 —107	104 —107	104	...
276,200*l*	Do. do. Bearer Nos. 1050—3,975 and 4,327—6,400 ...	100	104 —107	104 —107	104¼	...
320,000*l*	Do. 4 p. c. Debenture Stock	Stock	106 —109	106 —109	109	108
135,000*l*	{ Eastern and South African Telegraph, Ltd., 5 p. c. Mort. Deb. 1900 redeem. ann. drawings, Registered Nos. 1 to 2,343 }	100	102 —105	102 —105	...	...
180,400*l*	Do. do. do. to bearer, Nos. 2,344 to 5,500	...	102 —105	102 —105	...	...
201,600*l*	Do. do. 4 p. c. Mort. Debs. Nos. 1 to 2016, red. 1909	100	99 —102	99 —102	100½	...
45,000	Electric Construction, Limited, Nos. 101 to 45,100	10	6½— 7	6½— 7	7	6⅝
19,900	*Electricity Supply Co. of Spain, Nos. 101 to 20,000	5	... ...	... ..	...	...
66,750	Elmore's French Patent Copper Depositing Co., Ltd, Nos. 1 to 66,750	2	2½— 2¾	2⅝— 2⅞	2⅞	2¾
70,000	Elmore's Patent Copper Depositing, Limited., Nos. 1 to 70,000 ...	2	3⅜— 3⅝	3¼— 3½	3 9/16	3¼
67,385	Elmore's Wire Mfg., Ltd., Nos. 1 to 67,385, issued at 1 p.m., all pd.	2	1½— 1¾	1½— 1⅝	1 13/16	...
20,000	Fowler-Waring Cables, Nos. 301 to 20,300 ... (£4 10s. only paid)	5	2 — 3	2 — 3	...	...
180,227	Globe Telegraph and Trust, Limited	10	9⅝— 10	9⅝— 10	10	9¾
180,042	Do. do. 6 p. c. Preference	10	14⅜— 15	14⅜— 15	15	14⅝
150,000	Great Northern Tel. Company of Copenhagen	10	18¾— 19¼	18¾— 19¼	18 15/16	18¾
220,000*l*	Do. do. 5 p. c. Debs. (issue of 1883) ...	100	105 —108	105 —108	...	...
12,134*l*	Greenwood and Batley, Ltd., Ordinary, Nos. 4667 to 14,000 ...	10	8 — 8½	8 — 8½	...	...
9,600*l*	Do. 7 p. c. Cumulative Preference, Nos. 2,667 to 8,000	10	9½— 10½	9½— 10½	...	...
41,600	India-Rubber, Gutta Percha and Telegraph Works, Limited ...	10	20 — 21	20 — 21	20⅜	20¼
200,000*l*	Do. do. 4½ p. c., Deb., 1896	100	102 —104	102 —104	...	...
17,000	Indo-European Telegraph, Limited	25	41 — 43xd	41 — 43 xd	42½	...
11,334	International Okonite, Ltd., Ordinary Nos. 22,667 to 34,000	10	6 — 7	6 — 7	...	...
11,334	Do. do. Preference Nos. 5,667 to 17,000 ...	10	8¾— 9¼	8¾— 9¼	...	...
38,348	London Platino-Brazilian Telegraph, Limited	10	6½— 7½	6½— 7½	...	...
100,000*l*	Do. do. do. 6 p. c. Debentures	100	105 —108	105 —108	...	...
43,900	*Metropolitan Electric Supply, Ltd., Nos. 6,101 to 50,000 (£9 paid)	10	9⅜— 10¼	10 — 10½	10 7/16	10
447,234*l*	National Telephone, Limited, Nos. 1. to 438,984	5	4⅜— 4⅝	4½— 4½	4 9/16	4⅜
15,000	Do. 6 p. c. Cum., 1st Preference	10	12½— 13	12½— 13	12⅝	...
15,000	Do. 6. p. c. Cum. 2nd Preference	10	12 — 13	12 — 13	...	...
420,000*l*	Do. 4½ p.c. Deb. Stock Prov. Certs. fully paid ...	...	106 —108	106 —108	107⅜	106⅜
6,318*l*	Notting Hill Electric Lighting Company, Limited, £8 paid ...	10	6 — 7	6 — 7	...	...
220,000*l*	Oriental Telephone, Ltd., Nos. 80,001 to 300,000 (11s. only paid)	1	3/16— 5/16	3/16— 5/16	...	...
9,000*l*	Reuter's Limited	8	8 — 8½	7⅜— 8¼	...	...
18,680	St. James's & Pall Mall Electric Light Co., Ltd., Ord., 101—18,780	5	8 — 8½	8¼— 8⅜	8 5/16	8 5/16
7,900	Do. do. do. 7 per cent. pref.	2	7¼— 7⅜	7¼— 7⅜	7 11/16	7 7/16
3,381	Submarine Cables Trust	Cert.	118 —123	118 —123	120	...
78,949	Swan United Electric Light, Limited ... ... (£3½ only paid)	5	5 — 5½	4⅜— 5½	5¼	4⅞
37,350	Telegraph Construction and Maintenance, Limited	12	42 — 44	42 — 44	43¼	42½
150,000*l*	Do. do. do. 5 p. c. Bonds, red. 1894	100	102 —105	102 —105	104	...
58,000	United River Plate Telephone, Limited	5	1 — 2	1 — 2	...	...
146,370*l*	Do. do. 5 p. c. Debenture Stock ...	Stock	85 — 95	85 — 95	...	...
3,200*l*	Do. do. 7 p. c. Debs., Nos. 1 to 1,000 ...	100	... ...	... ...	...	...
15,609	West African Telegraph, Limited, Nos. 7,501 to 23,109	10	7½— 8¼	7½— 8½	...	...
271,400*l*	Do. do. do. 5 p. c. Debentures	100	98 — 101	98 —110	...	...
30,000	West Coast of America Telegraph, Limited	10	3½— 4	2 — 3	3	...
150,000*l*	Do. do. do. 8 p. c. Debs., repayable 1902 ...	100	98 —103	98 — 103	...	...
67,007*l*	Western and Brazilian Telegraph, Limited	15	10⅜— 11¼	10½— 10⅝	11⅛	10½
30,364*l*	Do. do. do. 5 p. c. Cum. Preferred	7½	6½— 7	6½— 7	...	...
30,364*l*	Do. do. do. 5 p. c. Deferred	7½	4¾— 4⅞	4 — 4½	...	...
189,700*l*	Do. do. do. 6 p. c. Debentures "A," 1910 ...	100	103 —106	104 —107	...	...
237,200*l*	Do. 6 p. c. Mort. Debs., series "B" of '80, red. Feb., 1910	100	103 —106	103 —106	...	...
88,321	West India and Panama Telegraph, Limited	10	1½— 1⅝	1½— 1¾	1¾	1⅝
34,563	Do. do. do. 6 p. c. 1st Preference ...	10	8⅞— 9¼	8⅞— 9¼	9 1/16	9
4,669	Do. do. do. 6 p. c. 2nd Preference ...	10	7½— 8½	7½— 8½	...	...
$1,336,000	Western Union of U.S. Tel., 7 p. c. 1st Mortgage (Building) Bonds	$1,000	120 —125	118 —122 xd	...	...
173,100*l*	Do. do. 6 p. c. Sterling Bonds	100	98 —102	98 —102	...	...
59,900	*Westminster Electric Supply Corp., Ord., Nos. 101 to 42,953 ...	5	5⅞— 6⅛	6 — 6¼	6 3/16	6

* Subject to Founders' Shares.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Blackpool Electric Tramway Company, Limited, £10 (£6½ paid), 7¼—7⅜.—City of London Electric Lighting (Pioneer), Shares of £50, fully paid, 60—62.—Ordinary of £10 each, £4 paid, 4⅛—4⅜.—Electric and General Investment, Shares of £5, £1 paid, 1⅞—2¼.—Elmore's Austrian Copper Depositing, 15s., 25s., £2 share issued at 10s. prem. fully paid, 1—1¼.—Elmore's Priorities, 3⅞—4⅛.—European Sims-Edison Torpedo Company, shares of £20, £10 paid, 10—10½.—Halifax and Bermuda Cable, 4½ per cent. bonds, 85—95.—House to House Company (£5 paid) 4⅛—5.—Liverpool Electric Supply, Shares of £5, £3 paid, 2⅜—2⅝. Shares of £5 (fully paid), 4⅞—5⅛.—London Electric Supply Corporation, Ordinary (£5 paid), 1⅜—2⅛.—Manchester, Edison and Swan Company, £9 (£1 paid), ½—⅝.—National Telephone Debentures, 2½—3 prem.—Woodhouse and Rawson Ordinary of £5 (£2 10s. paid), 2⅛—2⅜.—£5 Preference, fully paid 3¾—4.—Debentures, 90—95.—Wards Electric Car, £10 paid, ¾—1.

BANK RATE OF DISCOUNT.—4 per cent. (October 29th, 1891).

CONSIDERATIONS GOVERNING THE CHOICE OF A DYNAMO.*

BY PROF. E. P. ROBERTS.

(*Concluded from page* 516.)

ENERGY DEVELOPED BY THE DYNAMO.

The energy now to be considered is that delivered by the machine to the external circuit. The location and character of the electrical losses in the dynamo need not be taken into account by the station operator, with the exception of the consideration that energy lost in the dynamo is converted into heat, and in general the less heating the better will be the "operative" and "commercial" efficiency.

In order to determine the output of the dynamo, it is necessary to measure the difference of potential (P.D.) external circuit. This is usually accomplished by a voltmeter and an ammeter of the proper range to take the measurements desired. In whatever way the P.D. and C. are determined, their product gives the energy in watts, and this divided by 746 gives electrical horse-power. Electrical horse-power is the same as the standard mechanical horse-power, which is the work done by 33,000 pounds falling one foot per minute, or the equivalent of the same.

In order to determine whether the dynamo will do the character of work desired, it is operated at the speed given by the manufacturer (not at some other speed and calculations made therefrom), and the C. and P.D. at the terminals measured, the energy developed being absorbed by any form of R. convenient. A curve showing the C. and generator P.D. at various loads is constructed from data so obtained. If desirable, curves are made showing the output at various speeds. These curves are called "*characteristics*," and bear much the same relation to a dynamo that an indicator diagram does to a steam engine.

In some cases it is well to prove the dynamo by "short-circuiting" it, and sometimes by suddenly "open circuiting" it. Also to test the effect of slight variations in the position of the brushes.

From a financial standpoint the output per dollar expended is evidently of importance, and under the same head can generally be placed, though to a lesser degree, the output per square foot of floor space occupied; and, where height must be considered, the output per cubic foot of space, and sometimes also per pound of weight. In most station work, however, the weight and height need not be considered as between dynamos of the same output. A large dynamo is cheaper and occupies less floor space per watt developed than its equivalent of smaller ones.

The allowance for repairs is generally figured as a certain percentage of the first cost, and is determined by experience. This is a very uncertain quantity, but where great care is taken to properly clean the dynamo and keep the same in good condition (such as shellacing impaired insulation, &c.), and where open and short circuits do not occur on the line when operating, and the lightning arresters act properly, the repairs upon dynamos are usually very small, possibly not two per cent. per annum of the cost. In other cases it may reach any imaginable figure.

The output per dollar of attendance to clean is, more or less, the reciprocal of the above. The more cleaning the less repairs. Some dynamos, however, take much longer to clean than others, and some can never be thoroughly cleaned. The cleaning of dynamos is quite an expense in a large station, and an even larger percentage of cost in a small one, as a comparatively expensive man may have to do it at times when otherwise he might be more productively engaged.

The output per dollar of attendance while running varies greatly. With some dynamos and their auxiliary mechanisms so much attendance is necessary as to be a considerable item in a small station, taking all of one man's time in a medium sized station and the time of more than one man if a large number of dynamos are running. This emphasises the fact, which no one not an operating manager and superintendent of a station fully realises, that in choosing a system there are many points to be considered besides commercial efficiency, first cost and electrical output of the character desired and as indicated by the characteristic curve.

* Paper in *Journal of the American Association of Engineering Societies.*

The mechanical design should be such that the electrical functions of the different parts may not be destroyed by reason of insufficient rigidity, abrasion, &c. It is well to have the armature wires positively driven by the pressure of the parts of the armature frame. When an armature revolves rapidly, the wires, including the binding wires upon armatures using such, stretch and are liable to be more or less displaced unless firmly held. If shaft wires are used passing through the shaft to the collector, special care should be given to insure a smooth and ample space for placing the same in position, and that dirt be not allowed to settle about the entrance and egress holes. The mechanical design of the commutator includes the matter of proper insulating material between each of the commutator strips and between them and the shaft, the whole being put together in such a way that no piece is liable to work loose.

The electrical design necessitates that there shall not be continuity of the iron of the armature core. The reason for this is that the same force which tends to produce current in the wire would produce current in the iron and heat it if the electrical circuit be complete. Such currents are called Foucault currents. Armature cores are, therefore, made of iron plates, bands or wire, plates being used when the active wire is parallel to the shaft, bands when at right angles and wire being applicable to either case.

Heating.—Excessive heat will gradually carbonise the insulations of wires and render them brittle, and destroy their insulating properties. A safe temperature should not be exceeded after a three hours' run at full load.

What temperature is safe depends upon what the insulation will stand. In other words, high temperature is only injurious from the standpoint of reliability, because the insulation may be deteriorated, and the extent of insulation required is a function of the P.D., which may be increased much above its normal value when the circuit under consideration is suddenly opened, particularly if such consists of many turns about an iron core.

When the windings are of considerable depth, the external layers are cooler than the internal. In case of an armature, the external layers will be much cooler when running than those after stopping, as then the conduction of heat will not take place as rapidly, owing to less cool air coming in contact with the wires, and the temperature of the external wires will become more nearly that of the internal layers.

In any case it is advisable not to have the temperature rise so high that the back of the hand cannot be held against the wires.

Sparking.—The action of the commutating and collecting devices is, in many respects, a guide to the electrical action of the dynamo. If the dynamo be of the open coil type and designed for high E.M.F. and small current, a spark of considerable length can be run without burning the commutator. Such a spark may be run for a year or more on a machine properly attended to, and very little wear be perceptible. In closed coil machines, and in all large "quantity" machines, the less spark the better. Many may now be observed in operation with almost no perceptible spark, or even scintillation. If the field and armature are electrically balanced this can be accomplished, but the art of so balancing them is outside the province of a station constructing engineer. Whether the brushes are to remain unmoved and non-sparking for changes of load, or whether automatic or hand movement must necessarily or advisably accompany such changes, depends often upon the place where the dynamo is located, and the character of the work desired. In other words, whether constant attendance is necessarily provided for other work than to shift brushes, and, therefore, will be always at hand; and whether large percentage variations are liable to occur at any moment and unexpectedly. Generally speaking, everything should be automatic, but sometimes government is obtained by such a multiplication of devices, and accompanied by so many losses of power, that the advantages are not commensurate with the losses, and particularly with the attention necessarily given to keeping the automatic devices in order. The cost of time taken for this by an expert may even exceed that of comparatively unskilled labour for hand regulation.

The commutator and brushes constitute an important part of the dynamo, since the successful collection of the current depends upon their satisfactory operation. As shown before,

the requisite quality of the commutator is that it presents a uniform, smooth, and clean surface moving with moderate peripheral speed, against which the brushes may maintain easy but sure contact. Likewise the condition to be met by the brushes and their attendant mechanism is that they maintain sure and continuous contact with the revolving commutator, at the same time being well connected to the stationary conductor. This requires that the brush shall be of some good conducting material or that the holder grasp it as near as practicable to the commutator. The brush or the enclosing holder should have a certain amount of springiness. They should preferably be capable of adjustment while running without opening the circuit. Much ingenuity has been exercised upon the development of satisfactory brushes and holders, and many excellent designs are to be found on different machines on the market.

In a few machines the brushes are made to bear tangentially upon the commutator, but in most cases they bear obliquely. Tangential brushes have only a small surface of contact and are easily kept in order. The principal points to be looked after are to see that the brushes do not get worn through at the line of contact, and that they retain their elasticity and certainty of contact.

With the brushes set at an angle the surfaces of contact with the commutator are wider, being usually best when equal to the circumferential width of one commutator bar. The brushes should be filed off square and bevelled to the desired angle, then set in the holders or clamps so that the bevelled surfaces bear evenly upon the commutator; they should then be fastened tightly so that they cannot work loose or change position, and the springs adjusted to the proper tension for securing good contact with the minimum friction. The brushes should be kept clean, so as to make good electrical contact both with the commutator and the holders. The ends should not be allowed to become dirty, rough, or ragged, and may be cleaned occasionally by washing in benzine. As the brushes wear they gradually change their angle and their position on the commutator and leave the non-sparking point. They should, therefore, be trimmed occasionally and reset. Care must be taken that the brushes touch the commutator at diametrically opposite points, and, to facilitate resetting, a pair of opposite bars should be marked with a centre punch or chisel mark.

It is desirable, especially for machines giving large quantity of current, that there be two, or more, brushes on a side, both to reduce the resistance by increasing the amount of surface between brush and commutator, and, so that the operation of the machine will not be entirely dependent upon the proper working of any one brush. When there is more than one brush on a side they should all be set in a line so as not to cover a wider angle on the commutator than should be covered by any one brush, unless such separation of brushes is part of the means for regulating the dynamo.

"Carbon brushes" have recently come into quite general use and are popular, since they do not require so much attention and care as those of copper. They also reduce that part of the sparking due to the short-circuiting of armature coils, when the brushes touch two adjacent commutator bars, since the carbon brushes have more resistance than those of copper. In many cases the carbon brushes simply replace the copper ones, and are used in the same holders, but more frequently special holders are used.

When the commutator is in good order and the brushes well set so that there is little sparking, the commutator will acquire a glazed surface and will run for months with no other attention than being occasionally oiled. To reduce the abrasion between commutator and brushes a certain amount of lubrication is desirable, but this should not be excessive; such lubricators, as a rule, are insulators, and their presence between the brushes and commutator, except in very small quantity, introduces injurious resistance. A small amount of resistance from this source is less objectionable with high-tension machines than with low-tension. Too much lubrication will prevent the brushes from making good contact, and the sparking that follows will char the oil and insulation, and cause more or less short circuiting of the commutator. Some makers provide automatic commutator oilers, but for most cases occasional wiping of the commutator with a piece of cloth or felt impregnated with oil or vaseline is sufficient. For low tension machines a convenient and satisfactory plan is to put a drop or two of oil on a clean finger, shake off the excess, and rub the finger over the commutator. Some of the carbon brushes are partially composed of graphite, which furnishes the desirable amount of lubrication. Another plan is to boil the carbons in vaseline, which will serve the same purpose without lessening the conductivity of the brush.

When the surface of the commutator becomes dark and dirty it should be scoured off with fine sand-paper. The commutator should not be allowed to get dry, since it then scours, and there is more or less cutting of both brush and commutator, accompanied with undesirable throwing of copper and carbon dust.

Construction.—This can be suitably examined under the heads of Material, Workmanship, Balance of Rotating Parts, Methods of Manufacture and Insulation.

Material should be what it is represented to be. There is little danger of an efficient dynamo being lacking under this head, unless, possibly, a flaw be found in the shaft or pulley.

Workmanship is to be judged from the standpoint of a machinist who has a knowledge of the electrical functions of the different parts. An electrical machinist used to dynamo work is needed to find flaws in workmanship.

Balance.—It is very important, not only for quiet but for continued running, that the revolving portion should be in good running balance. If the armature is of the disc pattern on a long shaft, a static balance will give a "running" or dynamic balance. If, however, the armature be of the drum pattern, a system such as is used by the Alliance Company or a machine of the character designed by the writer should be used.

Method of Manufacture. (*Gauge or Interchangeable System.*)—It seems hardly creditable that in these times and in this country any machine made in quantities should not be made to gauge; but sometimes it is a fact that a part of a machine "made to gauge" breaks, and the new part does not, unaccountably perhaps, fit.

Insulation.—The insulation of any machine is usually designed with reference to the E.M.F., and for safe running in a dry locality. If dampness or injurious vapours or excessive heat be present, special insulation should be provided. When a dynamo has become wet it can be dried out by means of a current. It is best to obtain such current from an external source, as then the P.D. between continuous portions is only that due to the R. and not that generated in such portions when acting as a dynamo. If time is not of importance, it can be dried with more safety by placing it upon a boiler, and having the core of the magnet rest upon the shell or dome. This method will, generally, take two weeks to dry out a deep winding.

If an electrical engineer be employed to examine a dynamo, he may not actually write out his opinion under each of the above headings. He will determine the characteristics and horse-power consumed, and many of the other points will be merely considered together under the head of excellent, fair or poor in electrical or mechanical details, or in both.

An electrical engineer who has not had enough experience to grasp, as it were, intuitively the detail feature, and decide thereon without actual analysis, is very liable to a more or less serious omission, and regret it afterward, unless he proceeds in a systematic manner. In any case system is advisable, and clients will have a better opinion of a paper which takes up its subject and deals with it fully and comprehensively, than if generalities only be presented, and those of the character of the Delphic oracle.

THE ELECTRIC LIGHTING OF PARIS.

THE municipal authorities of Paris are at the present moment greatly exercised, in various ways, in connection with the above subject. In the first place, Dr. Arthaud, at the last meeting of the Academy of Medicine, informed that body that the examination of 35 patients, nearly the whole of the staff of the municipal electricity station, which only numbers from 35 to 40, permitted him to verify the existence of an epidemic of tuberculosis in that station. Out of 35 of the men he found 32 to be tuberculous, four of whose attacks were of

ancient date, and 23 whose inoculation was certainly prior to their entering the municipality's service. Our contemporary, *Le Temps*, furnishes a possible explanation of this state of health among these men. It says: The municipal electricity—for the City of Paris supplies electricity to the public—is produced by a station installed in the basement of the Halles Centrales. This station is built on deplorable sanitary conditions, the temperature rising to 40 degrees. The authorities have tardily recognised that they must ventilate the premises, and ask 16,000 francs to instal a large ventilator. The Municipal Council voted this sum, evidently wishing that the working of the electricity station should leave less to be desired, for the working is not quite agreeable to the public. A tradesman living in the district served by the municipal station, asked a few days since for the electricity necessary to light 20 lamps. He was told he could only have enough for 10. M. Muzet, who brought forward this matter, asked for an explanation, and the authorities told him that the production of the municipal station is limited; that at certain hours it was totally utilised by the present subscribers and the public services, and that, consequently, new subscribers could not be accepted. "But," objected M. Muzet, "why, then, have you laid down expensive canalisations in the streets if you cannot supply electricity?" "Give us the money to buy new machinery," was the retort. And this ended the matter. Another amusing discussion also arose as to the construction of a box for the *concierge* at the same station, on a report by M. Denys Cochin. The necessity for this box was not shown, and the reporter, with the approval of the Council, asked for further information.

While the municipality has these and similar momentous questions to settle, a glance at the position of a public company—the Popp—will show the difference in results between State and private working. This company, which has been, and is likely to be again, so prominent in connection with the electric lighting of Paris, has a capital of 10,000,000 francs (£400,000), and it was started with a fourfold object: distribution of motor power by compressed air to houses, distribution of the electric light, preservation of meat and other commodities by cold air, and distribution of the time. Of late years, and especially in 1891, it has carried out considerable works in Paris. The principal streets of the 1st, 2nd, 3rd, 4th, 9th, 11th, and 20th arrondissements have been canalised, amounting to about 389 kilometres, the number of lamps installed being 40,000. The company's works are five in number:—Saint Fargeau, Retiro, Bourse du Commerce, Boulevard Richard Lenoir, and Quai de la Gare, which account for about 15,000 horse-power in all. There are 24 electric stations, provided with accumulators and capable of feeding 80,000 lamps; while with the projected canalisation from the Quai de la Gare, to be opened in a month's time, the company will be enabled to keep 120,000 lamps going. The two stations of the centre horary of the Rue Sainte Anne, installed 11 years since, and of the Rue de la Franche Comté, can regulate 25,000 pneumatic pendulums each. The system of canalisation adopted with holes every 25 metres permits of all necessary repairs and alterations being effected without making fresh openings; all the cables are also encased in India-rubber, which renders the possibility of accident or interruption remote.

BAGNOLD'S PATENT IMPROVED BELL-PULLS AND BELL-REPEATERS.

FOR over forty years the familiar push-button used in conjunction with electric bells has remained unaltered except as regards the artistic design of its exterior, notwithstanding that considerable inconveniences are connected with the use of this simple household convenience.

The ordinary push-button must be pressed in a direction at right angles to the surface of the wall or other support to which it is fixed. Again, the contact made is not always of the best. It is essentially a "butt" contact, and possesses little or no self-cleaning powers.

When definitely established, say, in the immediate neighbourhood of a bed, or of an office or dinner table, it is difficult to actuate these push-pieces from any other position. Pull-pieces have been devised, but these need to be pulled, as a rule, in one particular direction. Flexible cord connections are also used, connected to "pear" shaped pushes, but these again are very liable to derangement, and may be said to contain the elements of their own destruction.

Generally speaking there are many instances of daily occurrence in which the shifting of a bed, of an invalid chair, or of a writing table, necessitates the advent of the electric bell-hanger, and the moving of the contact piece from one position in the room to another. In order to obviate these inconveniences, Siemens Brothers & Co. are now supplying, under license from Major Bagnold, a simple and effective arrangement of bell-pull which, no matter where fixed in a room, can be easily actuated from any point in that room by attaching a thin cord, and leading this cord away in the desired direction; only a very slight pull on the cord is necessary to make contact and ring the bell.

A diagram of the bell-pull and connections is shown by fig. 1. An elastic rod of steel, R, R, is set vertically with

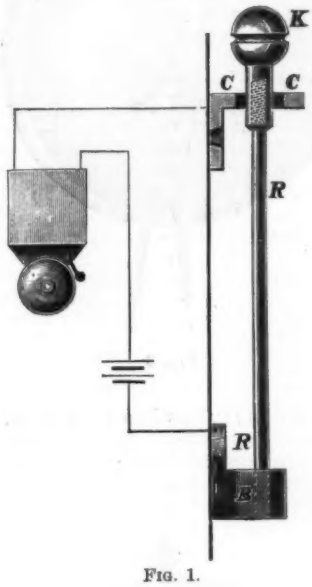


FIG. 1.

its lower end firmly fixed into a brass block, B, on its upper end is screwed a brass knob, K, the shank of which passes through a brass ring, C, C; the conducting wires are attached to B and C.

A slight pressure applied to K in almost any direction other than in that of the axis of the rod, R, R, will deflect that rod and cause the shank of the knob to touch the ring, C, C, and make the necessary contact.

FIG. 2.

This contact needs no silvering or platinising, as the knob can at any time be given a circular motion which will clean the contact surfaces and ensure the establishment of the circuit.

If it be desired to actuate this contact-piece from a distance, it is only necessary to tie a fine cord round the hori-

zontal groove on knob, K, and this cord can be led off in any required direction, such as to a bed, a chair, or a dinner table.

This bell-pull, which is also shown by fig. 2, is made in various patterns and sizes. It can also be conveniently combined with a sound repeater.

When a bell-pull or push is actuated, it is of immense convenience to be able to know that the electric bell has rung. figs. 3 and 3A show a new form of sound repeater which, combined with the contact previously described, makes a most convenient and efficient fitting for this purpose.

In fig. 3 the repeater is shown complete with the nickelled

FIG. 3.

steel bell dome, and in fig. 3A without the dome. When the latter is screwed on, one pole of the electro-magnet is presented to the sound boss of the bell; as soon as the contact is closed and the circuit is intermittently interrupted at the

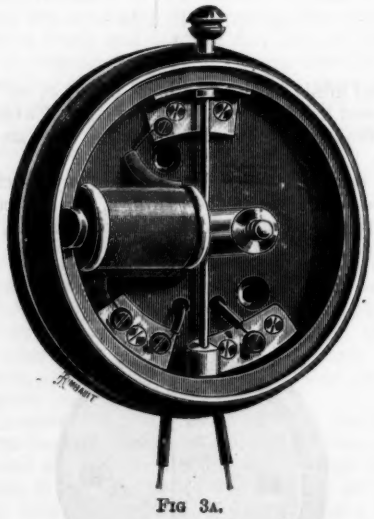


FIG 3A.

distant "chattering" bell, the bell dome of the repeater is set into vibration, and gives out a clear ringing sound sufficient to indicate that the distant bell has acted, but not so loud to be inconvenient to the occupants of the room in which the contact is made.

The above-described system of ringing a steel bell mag netically can be applied in other ways, thus, supposing it is desired to actuate several bells in series on one circuit, one of these can be an ordinary "chattering" bell, and the others can be simply "sound repeaters" without contacts. No difficulty of adjustment is experienced, as in the case when ordinary chattering bells are joined in series.

REVIEW.

The Practical Telephone Handbook. By JOSEPH POOLE. Whittaker & Co.

This is a book which will be of interest to all who are engaged in telephone work. On some of the topics touched upon it requires to be read in connection with our recent articles and correspondence, but its value chiefly lies in the instructions on practical work and the diagrams and descriptions of apparatus. The instructions and descriptions are, in the main, terse, clear and practical, and cover sufficient ground to be of value to the fitter of a few telephone lines for private use or one engaged in exchange work. The descriptions of apparatus include some which have already been published, but in more expensive works, and some others not previously published. The book bears some evidences of hasty production, but probably the demand for a second edition will afford an early opportunity for the correction of such minor inaccuracies as it contains.

NEW PATENTS—1891.

17,836. "Improvements in and relating to electric meters." R. N. LUCAS. Dated October 19th.

17,849. "Improvements in electric light fittings." J. A. LEA, J. F. LEA and A. H. LEA. Dated October 19th.

17,852. "Improvements in telephone apparatus, or in telephonic instruments, and in coin controlled mechanism for use with, or in connection with same." F. J. PALMER. Dated October 19th.

17,855. "Improvements in wall plugs for electric lighting." W. T. PRESSLAND. Dated October 19th.

17,867. "Improvements in the means for preventing short circuiting in electrical apparatus fittings, lampholders, &c." H. C. GOVER. Dated October 19th.

17,906. "Improvements in electric belts and fastenings therefor, which are also applicable to corsets, gloves, bags, boots and shoes, and the like." J. J. APSEY. Dated October 20th.

17,907. "Improvements in electric signalling." A. A. C. SWINTON. Dated October 20th.

17,965. "An improved mode of and apparatus for transmitting and recording electrically autographic messages, signals, and markings." P. A. NEWTON. (Communicated by E. Gray, United States.) Dated October 20th. (*Complete.*)

17,971. "Improvements in electric clock winders." J. W. DU LANEY and C. F. DU LANEY. Dated October 20th. (*Complete*)

17,974. "Improvements in insulation for electric conductors." H. ALLEN. (Communicated by C. T. Snedekor, United States.) Dated October 20th.

17,994. "Improvements in and relating to electric batteries." B. SCHEITHAUER. Dated October 20th. (*Complete.*)

18,002. "Improvements in railway electric block signal systems." J. L. BURT and W. H. AGRICOLA. Dated October 20th. (*Complete.*)

18,011. "Improvements in telephone switchboards." A. WHALLEY. Dated October 21st.

18,019. "An improved ceiling rose or ceiling plate for suspending electric lamps." J. H. HINDLE. Dated October 21st.

18,044. "Coin freed apparatus for telephones." A. H. BROADBENT. Dated October 21st.

18,059. "Electrical counting apparatus." F. W. GOLBY. (Communicated by L. Goubert, France.) Dated October 21st.

18,080. "Improvements in fire alarm telegraphs." J. H. GREENWOOD. Dated October 21st.

18,083. "Improvements relating to electrical belts, corsets, and similar articles, and to electrodes therefor." C. B. HARNESS. Dated October 21st.

18,093. "New or improved automatic circuit closing device for electric fire alarms." E. J. ELKINGTON. (Communicated by the Compañia Electricista contra Incendios, Spain.) Dated October 21st. (*Complete.*)

18,097. "Improvements in galvanic batteries." C. N. SOUTHER. Dated October 22nd. (*Complete.*) [Date applied for under Patents Act, 1883, Sec. 103, 23rd March, 1891, being date of application in United States.]

18,143. "Improvements in the method of mounting storage battery plates." H. A. MAVOR, W. A. COULSON and S. MAVOR. Dated October 22nd.

18,162. "Improvements in electrical lamp and other fittings." H. C. GOVER. Dated October 22nd. (*Complete.*)

18,179. "Improvements in or relating to the coupling of dynamo-electric machines in parallel." A. GAY and R. HAMMOND. Dated October 22nd.

18,199. "Improvements in and connected with telephone exchange switches." A. MARR. Dated October 23rd.

18,205. "Improvements in dynamometers or force measures." G. R. POSTLETHWAITE. Dated October 23rd.

18,207. "Improvements in electric telephones." A. T. COLLIER. Dated October 23rd.

18,251. "Improvements in electricity meters." SIEMENS BROTHERS & Co., LIMITED, and F. G. BAILY. Dated October 23rd.

18,256. "An improved process for the electro-deposition of metal upon the surface of glass, porcelain, china, earthenware, and other materials." A. S. FORD. (Communicated by H. Pottier, France.) Dated October 23rd.

18,272. "Improvements in electric belts for body wear." J. CHADWICK. Dated October 24th.

18,280. "Improved submarine cable grapnel." W. C. JOHNSON. Dated October 24th.

18,285. "Improvements in electric switches." A. BURTON. Dated October 24th.

18,290. "Improvements in switches for electric lighting." A. P. LUNDBERG. Dated October 24th.

18,304. "An improved device for trueing the commutators of dynamo-electric machines." H. HIRST. Dated October 24th.

18,318. "An improved electrical safety switch." G. L. HALL. Dated October 24th.

18,348. "Improvements in or connected with the distribution of electricity." T. PARKER, J. H. WOODWARD and E. S G. REES. Dated October 24th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1890.

12,209. "Improvements in electric meters." R. HEURTEY, E. MEYLAN, and W. C. RECHNIEUSKI. Dated August 5th. 11d. The present invention has for its object a new meter for electricity, to serve as a coulombmeter or a wattmeter, working as well with alternating as with continuous currents. Consists of—1. An electric or other motor, of constant speed, imparting to a principal axis, by means of gear-wheels, a continuous and uniform rotatory motion, and developing at the same time the power necessary for the working of the meter. 2. An ampèremeter or wattmeter, constituted of an electric balance, of which the movable part come into mechanical contact with a stop, with a pressure proportional to the quantity to be measured. 3. An "elastic-cam" mounted on the principal axis, worked by the motor, and producing at each revolution a pressure upon the end of the balance lever, in the view of putting back the balance into equilibrium, without the intervention of the fixed stop. At this precise moment the weighing or automatic reading is done, the cam rises up to the lever, escapes, and regains its normal position, continuing at the same time to be actuated by the principal axis. 4. A registering apparatus and totaliser. 8 claims.

12,330. "Improvements in thermo-electric batteries." G. E. GOURAUD. (Communicated from E. N. Dickerson, of New York.) Dated August 6th. 6d. The body of the element is preferably composed of an alloy of antimony and zinc combined, in the proportion of three to two, the electrodes or connections being preferably made of nickel or nickeline. The end of the element is protected by a metal casing, ordinarily made of iron, and which extends over a part only of the surface of the element. The heat is applied to the protected end. 3 claims.

13,199. "Improvements in apparatus for electric telephone systems." J. GRAHAM. Dated August 22nd. 11d. Consists of a rotatory disc provided with a connecting piece or contact which, when the disc is made to rotate, is borne in line with a range of a number of other connecting pieces, said connecting pieces forming the terminals, or being in connection with the terminals, of separate telephone circuits or lines, each of such circuits or lines usually being distinguished by indicating numbers or letters. The said rotatory disc is provided with a knob or handle and a pointer for the purpose of moving the connecting piece to any desired circuit. The rotatory disc rests in whatever position it may be placed simply of its own inertia, and by placing the telephone receiver upon its rest the connecting piece is automatically brought back to the terminal of its own circuit from that of any other circuit by means of a simple device consisting in the arrangement of a lever and cord in connection with the telephone suspension lever. 5 claims.

14,484. "An improved combined electric switch and connecting or coupling device." R. B. EVERED and T. RUDLING. Dated September 13th. 8d. The inventors combine a switch with a wall socket or other socket having suitable terminals, and adapted to receive a plug having corresponding terminals, in such a manner that the act of completing the circuit effects the locking of the said plug in the socket, and the act of unlocking the said plug to permit its removal from the socket effects the breaking or interruption of the circuit, so that when the circuit is once completed the plug is not liable to accidental displacement, and before the said plug can be removed the circuit must be interrupted. 2 claims.

14,693. "Galvanic battery." J. P. BAYLY. (A communication from abroad by J. Siliceo, Jun., of Mexico.) Dated September 17th. 6d. Consists in forming the cell at its upper end with two openings, a large central one, and a smaller one at the side thereof. The openings are each provided with upwardly extending flanges. A suitable conical-shaped porous cup provided around the upper edge with an annular flange rests upon the flange of the larger opening to the cell. Placed within this conical-shaped cup—which extends into the liquid contained within the battery—is a zinc rod, which is preferably made in sections, each section having its ends tapped to receive the screw for connecting them together. The smaller opening in the cell is designed to receive the carbon stick. The battery thus constructed is charged with the ordinary fluid commonly employed. 4 claims.

15,328. "Method and devices for heating by means of electric currents." C. ZIPERNOWSKI. Dated September 27th. 6d. Relates to a soldering tool formed of a conducting core terminating in a point or edge in contact with the end of a conducting casing within which the core is enclosed, being insulated from the casing, except at its end. The core being connected to the one electrode, and the casing, which is held by a non-conducting handle, being connected to the other electrode, heat is developed at the end of the casing, which may be pointed or chisel-shaped to suit different soldering purposes. 1 claim.

15,536. "Improvements in telephone receivers, usable also as transmitters." A. T. COLLIER. Dated October 1st. 8d. Consists of an electro-magnet held in the centre of a disc or cylinder, the said electro-magnet having both of its ends free to actuate a tympan or vibrating disc, outside of which tympans a permanent magnet is placed in such a position that the electro-magnet and tympans shall be between the poles of the said permanent magnet. 5 claims.

15,792. "Improvements in incandescent electric lamps and leading-in wires therefor." B. J. B. MILLS. (A communication from abroad by T. A. Edison, of America.) Dated October 6th. 8d. Consists in using leading-in wires of two metals, one section being of a metal having substantially the same coefficient of expansion as glass, such as platinum, the other being of a different and cheaper metal, both metals being sealed into the glass. The seal will remain perfect at the platinum sections, and it will therefore be immaterial if the copper or other wire contracts away from the glass, as described. 1 claim.

16,792. "An improved arrangement of regulating device for electric arc lamps." A. DE PUYDT. Dated October 21st. 8d. Claims: A regulator for arc lamps, consisting—1. Of a solenoid of fine German silver wire, communicating with the two carbons of the lamp and carrying a stationary iron tube and a movable iron tube, the latter being suspended from two blade springs, and the displacement of which causes the closing or interruption of the current towards an electro-magnet. 2. Of an electro-magnet subjected to the action of a solenoid or electro-magnet, the latter only acting by electrical contact, for the regulation of the arc. 3. Of a device for regulating the length of the arc, the said device being composed of an adjusting screw which, by means of a part, regulates the tension of a spring.

18,904. "Improvements in magneto-electric telephonic apparatus." H. T. O. FRASER. Dated November 21st. 8d. The inventor makes extensions from or connected with the respected poles of the magnets used for giving the current for sounding the bell, and upon one of these he mounts the transmitter coils, and upon the other the receiver coils, so that the said projections constitute the cores of the coils, and are magnetised by the said magnets; he also provides a handle for operating the generating coil or armature for ringing the bell at the distant station by a to and fro movement of the handle, which handle is pointed to the armature axis, and carries the hammer for the bell at the instrument where it is situated. 5 claims.

19,479. "Improvements in or connected with electric lamps for submarine work." J. H. TURNER. Dated December 4th. 8d. Consists substantially of an electric generator, attached to or combined with the apparatus for supplying air to the diver, connecting wires for conveying the electricity from the generator to the lamp below the water, a coupling for connecting the wires to the lamp switches for giving the diver and signalman control over the electric current and an incandescent or electric glow lamp. 4 claims.

20,329. "A tranformer of electrical currents for surgical, medical, and dental purposes." A. B. WOAKES. Dated December 12th. 6d. Relates to a means of utilising an alternating electric current, such as is used in connection with house lighting, for the purposes of rendering incandescent the platinum electrode of the electric cautery, for supplying a current for surgical electric lamps, and for all purposes where it is necessary to use an electric current varying in quality to that supplied for house lighting. 1 claim.

CORRESPONDENCE.

Railway Train Lighting by Electricity.

When I forwarded you my small contribution upon this subject I did so in good faith, and had no idea that my few remarks would have created such a *furore* in scientific circles both at home and abroad, or that you would have honoured me with a special article relative to any of my suggestions. But as you have commented upon the same in your usual *jocular spirit*, I feel I must crave a small space to reply.

In the first place, Mr. Langdon has no need to look to his laurels, as suggested by you, and so far as my opinion goes I think he has well earned them, and his system is probably the best of its kind.

At the same time I think if a self-regulating dynamo machine of the Waterhouse type were used, as suggested by me, I confidently believe that even still better results would be obtained, and that his system of lighting would then become one of the most perfect of its kind in existence.

Moreover, Mr. Langdon was the first railway engineer

who saw the benefits of adopting low-resistance lamps—a point of importance for this class of work in which I entirely agree.

Now, Mr. Editor, respecting your remarks. I feel you doubly honour me by grouping my name with the immortal Watt and the work of Stephenson. But there is just one point in the historical work of the former in which I cannot agree or coincide with your views. For you state that "Watt immortalised himself by watching the generation of steam in the kettle."

But, with all due respect to your opinion and that of other scientists, I venture to differ from you all upon this point, and would assert that *Watt* never saw the generation of steam at all in any shape, manner, or form, for the reason "that *steam is invisible, and its exact component parts in its various stages of expansion are unknown.*" But what Mr. Watt actually saw (according to my idea) emitting from the spout of his celebrated kettle was probably "*some condensed form of thermopolaic energy, compressed in its passage through the spout in the form of a vaporised mixture, made visible by coming in contact with the minute and invisible particles of ethereal energy floating and filling the surrounding space, and absorbed by the latent heat of this thermo-combustion of oxygen for which ethereal energy has an affinity for.*"

I may be before my time, as the Editor suggests, so simply record these original ideas as food for other scientists to feed upon, which, if properly digested, will prove itself to be practical.

Next, Mr. Editor, permit me, in order to satisfy your æsthetic taste, to state that I have not the least intention of covering the boilers with barnacle-like elements—"certainly not." My ideas are far too artistic for that. I have, as is well known, always urged artistic designs in electrical work, hence it would go against the grain to waver from it, even in carrying out these thermopolaic experiments, nor have I the least idea of leaving these specially-constructed elements to "the mercy of the winds or snow." But so far as the changes of heat and cold are concerned, this is a point I thank you for, and I think I foresee a plan of grappling with the difficulty, but for obvious reasons I must be content to wait until the old kitchen boiler convinces and proves to me that my theory upon this point is correct, after which I may be tempted to try a larger experiment upon some railway locomotive. In the mean time, Mr. Editor, I would just say that I like a joke, and can appreciate pure sarcasm as well as any man in the world, for the simple reason that my back is broad and my temper good; so I make it a rule never to porcupine or bristle up as some men do, well knowing that the press is impartial, and means well, and always glad of the opportunity of presenting its readers with an occasional dish of lamb and mint sauce as a nice little change to the usual beef and mutton diets we are compelled to subsist upon as supplied by the technical press.

As to your correspondent's questions which appeared in your issue of the 16th ult., one would fancy that he is either a lamp maker himself, or a shareholder in some company interested in the lamp industry, and apparently fishing for information on his own account, so I would say for his private information that my lamps are obtainable abroad, and are largely used on the continent and in America. But owing to a promise made to the Edison and Swan Company through the intercession of several of our most eminent judges, I have no desire, nor do I think the attempt to supply lamps in England for the next few years would be worth the candle.

Not knowing the worthy scientist who hides himself under the initials of A.I.E.E., I would just say that these four letters cover a multitude of sins, they also are frequently used as a handle to the names of very clever men, but unfortunately they are also used by fanatics as a fringe to their fallacious knowledge of science.

However, I will presume, for the sake of argument, that he is "a member of the middle class, as above described," and it may interest and gratify him to know that I do not as a rule spend my money on unworkable patents. But, having paid her Majesty for some years past some hundreds of pounds, another £10 note will not make much difference to this account in the long run. And as he virtually agrees with me as to the merits of adopting "a light-weight storage battery," a low-resistance lamp and "the advantage of obtaining perfect diffusion of light in railway train lighting," it closes the matter so far as the present systems are concerned, as no one has refuted the arguments used and set forth by

Arthur Shippey.

Telephoning of Great Cities.

I readily avail myself of your kindness in allowing the correspondence on the above subject to be continued in your journal.

Mr. F. F. Bennett after agreeing with Mr. Miller that the "call-wire system" introduced into India was the *Law*, not the Mann, proceeds to describe the two systems. His statements that the *Law* has a metallic loop never connected to earth, whereas the *Mann* system is connected to earth at every subscriber's office, proves beyond doubt that the system worked in India was the *Mann*, and, provided this gentleman's statements are correct gives another instance where the Mann system has been abandoned. Your readers will only require a few more such statements to convince them that the advocates of the "call-wire system" are pushing it to the front for other reasons than that of showing its superiority.

In reply to Mr. Poole I do admit that Paris represents telephony on a large scale, but I do not admit that Paris is worked on a call-wire system. I thought when mentioning that the several sections of the call-wire were connected at night to one *phone*, it would be understood by all to mean connected to one table, with the necessary apparatus for working same. If a *bell* is used at night only in Scotland and the North of England, the people up there show very little consideration for their operators. In India a *bell* was not only used at night, but each section of the call-wire was connected to a *bell* during the slack hours in the day.

When I am endeavouring to show your readers that Mr. Bennett's call-wire system is identical with that *once* used in India, I see no reason that my diagram should not correspond with his, provided it be correct, and I vouch for its absolute correctness.

It is worthy of notice that only the unimportant parts of my letters have as yet been replied to; the advocates of a call-wire system must find themselves hard pressed when they have recourse again to *quibbles*, leaving the main question to take care of itself.

H. Goodwin.

November 2nd, 1891.

With reference to Mr. Poole's remarks last week, will you permit me to say that no switchboard has been abandoned, that the switchboard he refers to was designed for 12,000 and is now fitted for 6,000, all the Exchange at present requires, and that the small size jacks I previously mentioned have been in actual use for some years in several Exchanges.

I may also take this opportunity of adding to my last week's letter that the technical arrangements at Manchester were carried out under Mr. Poole's direction, and that some of the details in the fitting up of the apparatus were designed by him, and contributed to the generally satisfactory results.

J. E. Kingsbury.

November 3rd, 1891.

The Engineer as a Gentleman and a Scholar.

In an article in this week's REVIEW, in which you rightly insist upon the importance of the possession by an engineer of cultured courtesy, you are discourteous enough to sneer at certain opinions and schemes held and trusted in by a large number of people. You apparently do not remember that the REVIEW is a technical journal. The introduction of such remarks is exactly analogous to hitting a man whose hands and feet are tied.

An economic discussion is not possible in such a paper as the ELECTRICAL REVIEW.

J. Sayers.

November 2nd.